

*Stated Meeting, April 7, 1865.*

Present, fourteen members.

Dr. WOOD, President, in the Chair.

A letter accepting membership was received from Dr. G. Smith, dated Oxford, February 16, 1865.

A photograph likeness of Col. J. D. Graham was received, dated March 28, 1865.

A letter inclosing a photograph of casts of Indian hieroglyphics cut in the rocks at Safe Harbor, on the Susquehanna, was received from Prof. T. C. Porter, of Lancaster, dated April 1, 1865.

“I inclose much reduced photographic copies of figures carved by the Indians on two gneissic rocks (A and B), in the Susquehanna river, below the dam at Safe Harbor, Lancaster County, Pa., drawn from casts in plaster, taken under the auspices of the Linnæan Society of Lancaster County, in the autumn of 1863 and the summer of 1864. The casts are boxed up and ready for sending to the Smithsonian Institution. The largest figure is over three feet in length. When the season arrives, we will secure for you a full set of casts in plaster, from which accurate drawings can be made.

In the month of September, 1863, the existence of figures chiselled out by the red men of our stone period on certain rocks in the Susquehanna River became known to the Linnæan Society of Lancaster County, and a committee was appointed, with the president, Prof. T. C. Porter, as chairman, to visit those rocks and obtain casts of the figures in plaster. The work was begun and carried on during the month of October, but not completed till the summer of 1864, the rocks being accessible only at a low stage of the water. Drawings on a greatly reduced scale were made from the casts by Mr. Jacob Stauffer, and photographic copies, still more reduced, by Mr. W. Gill, members of the Society. Those under the letter A belong to the larger rock, and those under B to the smaller one. The intention is to furnish the American Philosophical Society with a full set of casts, in order that a permanent record may be secured in their Transactions. Search for the implements used in cutting out

the figures has, as yet, been unsuccessful. The following facts were collected and reported by the committee.

*Position of the Rocks.*—The Susquehanna river below the dam at Safe Harbor, Lancaster County, is filled with a multitude of rocks and rocky islets, various in size and extent, between which, the fall being considerable, the water rushes, forming a series of rapids and eddies, navigable only by canals. The width of the stream at this point is scarcely less than a mile, and the jurisdiction of Lancaster County extends to low-water mark on the York County shore.

Among these rocks are the two in question.

The larger one, A, lies a full half mile below the dam, in a line nearly due south from the mouth of the Conestoga.

The smaller one, B, is situated about 250 yards further up, in the same line, at a distance of some 400 or 500 yards from the eastern shore.

The currents around both rocks are strong and swift.

*Their Character.*—Each rock is composed of several masses overlying each other at an angle of  $45^{\circ}$  down stream, the lines of division running east and west, the southern crest being the highest. They consist of gneiss, which is rather friable within but hard on the outside. The surface is roughened by grains of quartz, and here and there are seen distinct veins of the same material. The portions facing up stream have been rounded and worn smooth by the action of ice and drift-wood during the high freshets of early spring, as may be inferred from the logs piled upon and around them, and from the striæ or grooves on the larger rock, produced probably by angular pieces of stone imbedded in cakes of ice. Each rock has also, extending a little distance below it, a tongue of land on which grow dwarf oaks, dogwoods, and a few herbaceous plants.

*Their Dimensions.*—Rock A measures through the centre, from north to south, 82 feet, and from east to west 40 feet. It slopes gradually upward from north to south; the lowest part being 9 feet, and the highest 16 feet above low-water mark. This rock is said to be the highest in the river near Safe Harbor, and from its flat summit the prospect is extensive and beautiful.

Rock B measures, from east to west, on the north side, 20 feet; on the south side, 29 feet 8 inches; from north to south, on the east side, 12 feet 9 inches; on the west side, 8 feet 6 inches. The height on the west side above low-water mark is 6 feet; of the east side, 12 feet 9 inches.

From the east side a huge mass has been broken off, perhaps

during one of the ice-gorges which sometimes occur in the river at this spot. It has fallen into the bed of the stream with the fractured end uppermost. Its length is 12 feet 9 inches, and its computed weight 27 tons. The oldest fishermen about Safe Harbor know nothing, either from their own observation or from tradition, as to when the disruption took place; and yet it must have happened since the figures were cut upon the rock, for those found on the outer perpendicular face of the fragment evidently belong to the same series as those on the upper level surface with which it was once continuous.

*The Figures.\**—The two rocks contain in all upwards of 80 distinct figures, and a number more almost obliterated. They are much scattered, and seem to have been formed without regard to order, so that it is not possible for an unskilled observer to say that they bear any necessary relation to each other. They are probably symbolical, but it is left to those who are versed in American antiquities to decipher their meaning.

Some points, however, are clear. They were made by the Aborigines, and made, at a large cost of time and labor, with rude stone implements, because no sharp lines or cuts betray the use of iron or steel. This, in connection with their number and variety, proves that they were not the offspring of idle fancy, or the work of idle hours, but the product of design toward some end of high importance in the eyes of the sculptors.

Letters requesting subscriptions to historical publications were received from J. G. Shea, No. 83 Centre Street, New York, and Rice, Rutter & Co., Philadelphia, and referred to the Library Committee, to take order.

A letter requesting a copy of the seal of the Society for use in his forthcoming book on American Seals, was received from A. B. Weymouth, No. 9 Green Street, Boston, and on motion granted.

A communication was received from Mr. P. W. Sheaffer, in the form of a MS. section, showing the levels relative to tidewater of the various coal and oil regions of the United States, in a letter dated March 20, 1865. The MS. has been used by Mr. Eli Bowen, in publishing his late work on coal and coal oils.

\* See Plate I.

Mr. Lesley took occasion, in presenting this communication of Mr. Sheaffer, to describe the method of the existence of the petroleum in the eastern coal-field of Kentucky, which he had lately visited.

The whole surface of that part of the State of Kentucky, watered by Paint Lick Creek and its tributaries, is a mass of hogback ridges, sharp conical hilltops, and profound rock gorges with steep or vertical walls, bordered by a broken highland of coal measures. The highest hilltops of which are about 700 feet above the beds of the deepest gorges, or cañons.

The wildest and most beautiful scenery meets the eye at every turn; long walls of rock, with their edges against the sky; extraordinary piles of pulpit-rocks, standing isolated at the junction of two streams; overhanging tablets of sandstone, two hundred feet long, and thirty feet thick, projecting twenty feet beyond their supporting cliffs, and a hundred and fifty feet above the spectator's head; dark forest gorges, heading up in caves, over the roofs of which fall high cascades; and in the decomposable faces of the cliffs, bear-dens, and robber-caverns, and pit-holes of all sizes, sometimes so numerous as to give the traveller the impression that he might make out old inscriptions, with a genuine meaning in them, if he tried.

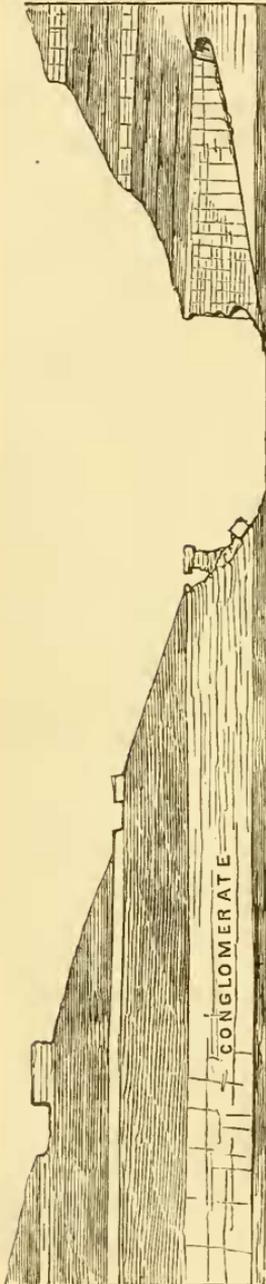
From the disintegration of this world of friable sandrock, from the slow cutting of the waters of all the forks of Paint, down through from 200 to 250 feet of such strata, in the lapse of geological ages, have come the incredible quantities of loose, yellowish sea-sand, which form the terraced banks of the Sandy River, fill up its valley-bed, and give to it its name.

There are other similar sandrocks,\* running horizontally

\* On Low Devil Creek, a head of Red River, at the 236th mile of the Base Line Survey, and therefore 50 miles west of Paintsville, the Tionista (Freeport?) Sandstone lies 80 feet above the Conglomerate, and is well filled with plant impressions, and has thin coal-seams wedged in between its layers. S. S. Lyon, IV, p. 532.

through the hillsides, higher up in the coal measures, and forming crags and cliffs, caves, tables, pulpits, and ship rocks,

Fig. 1.



of the same picturesque pattern; but they are comparatively thin, and of small account compared with the vast stratum through which the cañons of the Upper Paint waters have been excavated; as the cross section (Fig. 1) will best show. Nothing, in fine, is more remarkable about these waters than the absence of boulders and fragments of rock in the beds of the ravines, the smoothness and gentleness of the main streams, and the incredible abundance of sea-sand; and that these features should coexist with the presence of lofty cliffs on every side, from which it would naturally be expected that thousands of fragments would fall and encumber the slopes. But, on the contrary, the homogeneous and friable nature of the strata has permitted the ordinary meteoric agencies, rain, frost, sunshine, and wind, to wear them down piecemeal, powdering up whatever débacle occasional uncommon storms might produce, and passing off the entire debris into the lower country of the Sandy and Ohio rivers. For there is no evidence that glacial action has ever had a hand in forming this topography.

*The Coal Measures* of the Paint Lick country contain at least four coal-beds; one of them underlying the Conglomerate, and the others overlying it. They are none of them large, but they will serve the purpose of local consumption; and, when fully explored, may prove

to be much larger and better than is now known, for the country is in so wild and undeveloped a condition, and the coal-beds of the Lower Coal Measures, to which these beds belong, are so variable, that they may be expected to present different aspects of size and quality on every different hillside.

The following scheme of the beds, showing their Kentucky and their Pennsylvania names in opposite columns, will be useful to enable one to understand them without confusion:

TOP HILL SAND ROCK = THE MAHONING SANDSTONE.

Coal No. 4 = Pomeroy Coal = Upper Freeport Coal.  
Coal No. 3 = Coxe's W. Liberty = Lower Freeport Coal.

MIDDLE SAND ROCK = THE FREEPORT SANDSTONE.

Coal No. 2 = Main Peach Orchard = Kittanning Coal.  
Coal No. 1, C = Clarion Coal.  
Coal No. 1, B = Wheeler's? = Brookville Coal.  
Coal No. 1, A = Tionista Coal.

MILLSTONE GRIT = No. XII = THE GREAT CON-  
GLOMERATE.

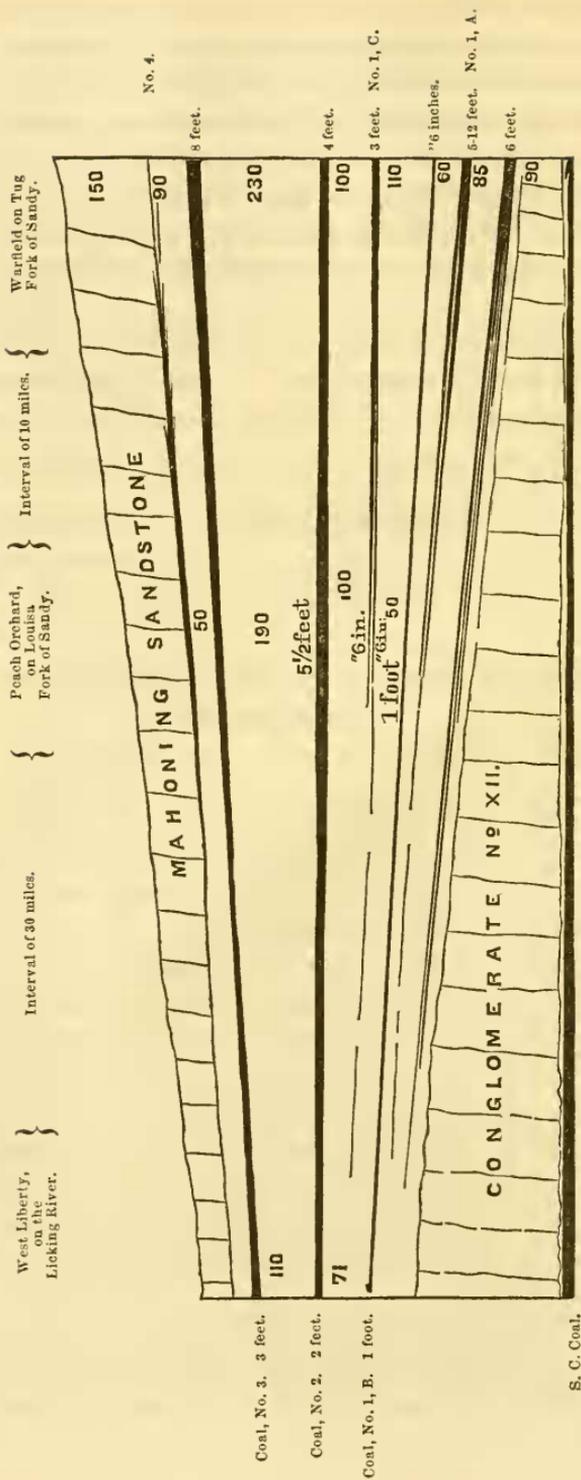
Coal Sub-conglomerate; = No. XI. Coal.

A few of the hills, being capped by the Mahoning Sandstone, contain all seven of these horizontal layers of coal; but the majority of the hills are only high enough to take in Coal-bed No. 2, the Kittanning bed.

It seems to be well made out, especially by the labors of Mr. Lesquereux, that the Coal Measures become thicker, and the coal-beds larger and farther apart, as one pursues them from the Licking Waters, in Magoffin and Morgan Counties, eastward, across Paint Creek, Jenny's Creek, and Louisa Fork, towards Tug Fork and the Virginia country. The accompanying diagram, Fig. 2, gives three of Lesquereux's comparative sections: one at West Liberty; one at Peach Orchard, on Louisa Fork; and one at Warfield, on Tug Fork of Sandy.

The Main Coal of the Peach Orchard mines,  $5\frac{1}{2}$  feet thick, seems to be the same bed with that mined on Paint Lick Creek, Wheeler branch, a mile or two west of Paintsville, at

FIG. 2.—EAST KENTUCKY COAL MEASURES.



an elevation of 195\* feet above the creek, 4 feet thick (without parting slates), and dipping locally 2° towards S. 80° E.

About the other beds we know absolutely nothing at all, except that one or more of them becomes of great size (6 to 10 feet thick) in the neighborhood of Prestonburg.

*The Sub-conglomerate Coal*, which is a respectable 4-foot bed in Middle Kentucky, † crops out all along the foot of the Conglomerate cliffs, in the cañons of Upper Paint Lick waters, just above water-level, and of variable thickness, being sometimes only a few inches thick, sometimes yielding two feet of coal, and sometimes showing an outcrop of mere black slate, three or four feet thick.

This is, perhaps, the 6-inch bed of coal which the three wells at Lyon's Steam Mill, at the mouth of Open Fork, are said to have passed through, not many feet beneath the water-level; but I think it more probable that it is a second and lower bed belonging to the Sub-conglomerate System, but of still less practical importance.

*A bed of iron ore* (blue carbonate of iron) everywhere accompanies the coal and black slate just under the Conglomerate Rock. But this, also—although well developed in Middle Kentucky,—seems to be of small importance on Paint Creek. Near the Lyon Well I saw it as a stratum of balls, 2 to 4 inches thick, enveloped in shales, and lying about 5 feet below the bottom plate of the Conglomerate. ‡ The shales are themselves ferruginous, and bog iron-ore springs issue from the edge of the stratum, in many places, forming puddles of yellow slime, which the people call sulphur, but which is merely iron-rust, commonly mixed, also, with oil.

\* Kentucky Reports, Vol. I, p. 210.

† See Joseph Lesley's Report in Kent. Rep. Vol. IV, p. 474. The bed near Proctor, Owsley County, is 42 to 50 inches thick, and is one of a system of Sub-carboniferous Coal Measures, consisting of five (5) beds.

‡ Some charlatan had given the neighbors to believe that it was an ore of platinum. Just as Owen describes "the Swift mine" of silver, near the Tennessee line, as turning out, on examination by him, to be merely dark gray kidney clay ironstone. Vol. I, p. 222. In Estill County, the ore varies from 7 to 24 inches, but rests directly on the sub-carboniferous limestone. Vol. IV, p. 471.

There are two other places for iron ore in the series, but they have not been explored in this neighborhood. *The Buhrstone Ore* of Clarion and Venango Counties, in Pennsylvania, and of the Hanging Rock Region of Ohio, and of Grayson and Carter Counties, in Kentucky, ought to come in between Coal-bed No. 1, C, and Coal-bed No. 2. But the Kentucky geologists conclude from their observations, that this remarkable deposit did not extend itself so far south in this direction.

*Another bed of iron ore*, however, exists on the hills on the east branch of Jenny's Creek, which probably spreads itself more or less through all the hills of the country. It underlies 30 feet of sandstone and 2 feet of shale; and it consists of a roof of pyritiferous sandstone, 8 inches; black bituminous shale, 1'10; iron ore, 2 to 4 inches; coal, 2'6; underclay, 1 foot.\* The inclosure of the iron ore between two bituminous beds, is not favorable to its quality. This is probably the same ore stratum which underlies the Top Hill Rock (Mahoning Sandstone), on the Licking waters,† and the Red River branches, where it is from 18 to 20 inches thick, and of good quality.‡ The situation in the series is precisely that occupied by the Summit Ore stratum of Armstrong County, in Pennsylvania. It deserves to be carefully studied.

*Petroleum* is the mineral that excites most interest at present in all this region, and the show which it makes upon the surface is extraordinary. It issues in numerous places from the base of the cliffs which form the walls of the cañons through which flow the main Paint and its many branches. It saturates the slopes and banks of loose sand. It flows off, when the sand is stirred with a stick, as a shining seum upon the surface of the stream. It has been caught against booms and barrelled for sale. It unites, also, with the sweepings from the Sub-conglomerate ore and coal shales, and forms slimy ore bogs and muck heaps, where the base of the Con-

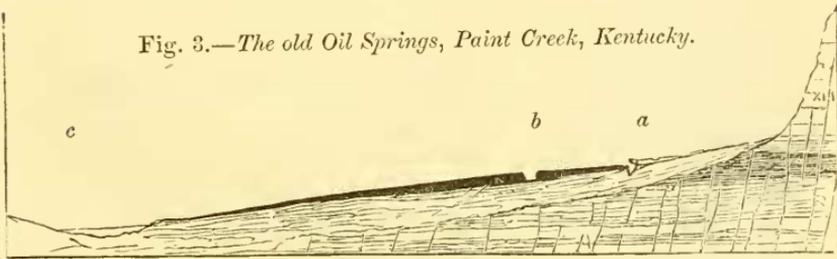
\* Lyon's Report, Vol. IV, p. 543.

† Idem, p. 538, 537.

‡ Idem, p. 535.

glomerate is at any greater height than usual above the water-bed, and the slope from it is, therefore, longer than usual. Such is the case at the Old Oil Springs, on the north line of the May & Ross Survey, where it crosses the Oil, Little or South Fork of Paint; and again 200 yards lower down, at Pendleton's Oil Spring.

A black reservoir of tar-like oil here occupies the centre of a sloping bog, and is kept always full from a spring at its upper limit, near the top of the slope and the foot of the cliffs, about 20 feet above the level of the stream. Figure 3 shows the conformation of the ground; *a*, the spring; *b*, the reservoir; *c*, the bed of Paint Creek.

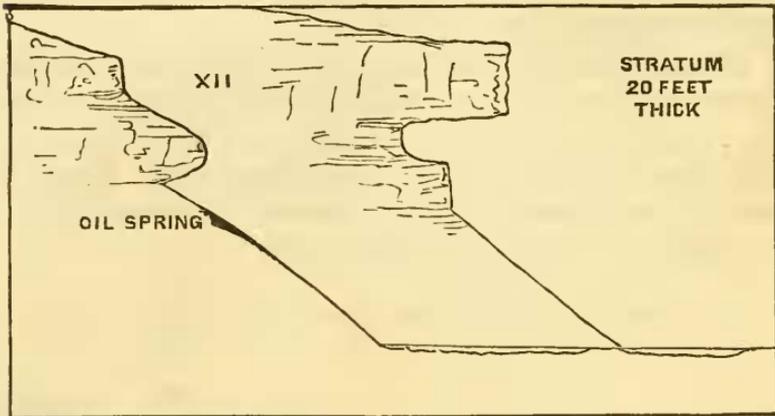


A mile further down the stream, but on the opposite or right bank, and apparently 35 or 40 feet above the water, on a steep slope, close under projecting cliffs, is a similar spring, which has not produced any extensive bog, for want of a level receptacle, but which has yielded "large quantities" of oil in past years, and from which the petroleum continues to run slowly all the time. Fig. 4 shows the contour of the ground and the overhanging cliffs, at two places near the spring.

Three miles further down the stream, and within a mile or less of its junction with the North or Open Fork, at Lyon's Well, the oil is to be seen coming from the edge of the coal- and ore-shales, just under the cliffs, which here tower to an amazing height, especially upon the west, or Emigh Survey side; the survey cornering upon the stream close by, at a stump, at the mouth of a little run. Fig. 5 represents, in a formal manner, this section, and a pile of Conglomerate erag, called the Crow's Nest, between one and two hundred feet high, wonderfully tower-like and regular, opposite.

There are here, immediately underneath the lowest plate of Conglomerate (20 feet thick), 5 feet of shales, then two feet of yellow sandstone, then  $1\frac{1}{2}$  to 3 inches of ball ore,

Fig. 4.—On Little Paint Creek, Kentucky.



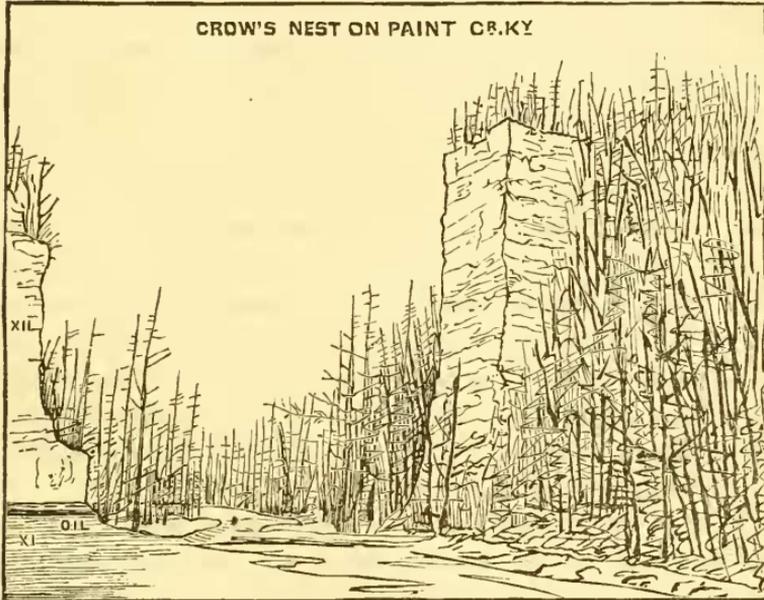
then black and blue slates to the creek level. A mile or two up the creek, and perhaps half a mile above the mouth of the Mine Fork, there are in these black slates two distinct beds of coal, 6 feet apart: the upper 10 inches, the lower 24 inches thick; and oil flows from them continually in small quantities. The extraordinary erosion of these valleys could not be studied anywhere to better advantage than at the junction of the Mine Fork with the South Paint. The topography is exactly reversed. The nose of rock making the fork, itself one of the most romantically picturesque piles of pulpit rocks to be found in the United States,\* points up stream instead of down, the tributary Mine Fork meeting the main stream fair in the face. (Fig. 6.)

From the Crow's Nest down to the Lyon Well, and further on down the Main Paint, the same appearances repeat themselves. Here are to be seen the old "stirring places," where, before the rebellion broke out and put an end to all manner of trade in Kentucky, Mr. George and others collected oil

\* I have given the crag at this point the name of the Propylon, because of its remarkable likeness to that feature of Egyptian architecture.

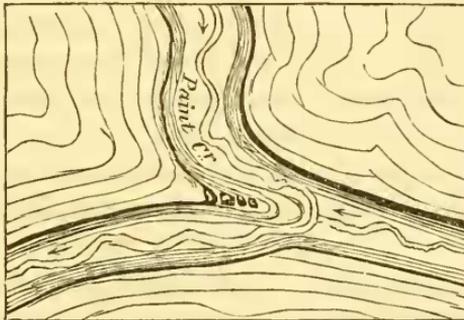
from the sands, by making shallow canals one or two hundred feet long, with an upright board and a reservoir at the lower

Fig. 5.



end, from which they obtained as much as two hundred barrels per year, by stirring the sands with a pole. The same

Fig. 6.



method has been employed, with like success, as far down Paint Creek as the cliffs continue high; that is, to within six or eight miles of Paintsville.

At Davis's, where the road crosses Paint Creek, just below the mouth of Little Glade Run, and in the midst of the finest cliff scenery,—the Conglomerate being here 230 feet thick, and the streams flowing at the bottom of it, between long straight vertical walls,\*—the black petroleum is perpetually welling out, not only from under the Conglomerate, but from crevices in the bare faces of the rocks, and accompanied, as elsewhere, by yellow peroxide of iron. In the holes scooped out of the sand and mucky banks of the run, the oil rises visibly to the surface in clots, looking not unlike dead tadpoles, which, slowly forming discs, widening and uniting with each other, and covering the puddles with an iridescent coating, flow off into the stream. The painted water is no curiosity, for we have been familiar with it as a guide to coal-beds, and especially to the Sub-conglomerate ore-bed of No. XI, these many years, although we never suspected its connection with petroleum. But the clots of black petroleum are very curious and characteristic.

It is evident, from the description given above, and the same description will answer for a large number of similar springs in the numerous gorges through which the Licking waters find their way westward into the Blue Grass country of Middle Kentucky, that the petroleum of the oil springs of Paint Creek has had its home in the great Conglomerate at the base of the coal-measures; *still has*, we may say; for it is still issuing, in apparently undiminished quantities, from the same. How it came to be originally packed away there; how long a time it has lain there; how much of it has managed to sink slowly down through the mass, and collect itself as a layer at its bottom level, just over or in the ore and coal-shales; how much of it still remains disseminated through the mass; how recently the streams have succeeded

\* Some of the walled sides of the Little South Fork of Red River are said to be impracticable for seven miles, where it is walled in, nearly perpendicularly, to the height of 200 to 300 feet without a break. The head of the Hotel branch of Graining Block Creek terminates abruptly against a cliff 250 feet high, the chasm being about the same width. S. S. Lyon's Report, K. R. IV, p. 531; 229th mile Base Line Survey.

in cutting down their cañons to the bottom of the sand mass, so as to afford an exit for that proportion of the petroleum which had there collected to begin its escape; how far the petroleum, in its downward progress, has passed through the ore and coal-shales, and has found still lower horizons to stop it, and is there waiting for the oil-well borers to come and give it issues to the surface; and to what extent, on the other hand, the deeper and older petroleums (of which I shall speak hereafter) have found fissures from below, up which to ascend to mingle with this petroleum of No. XII: these are questions of the greatest practical importance, which no one, so far as I know, has distinctly stated; and they can only be fully answered after long practical investigation.

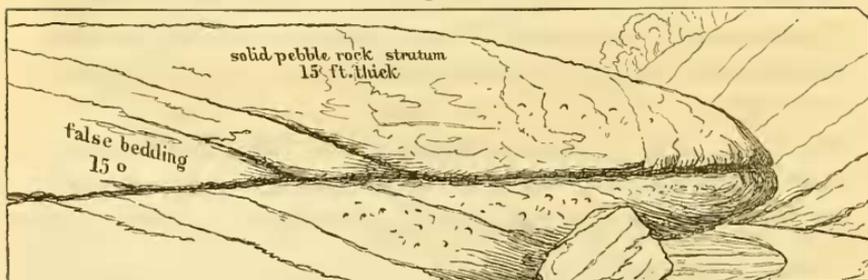
*A Conglomerate age or horizon of petroleum* exists: this is the main point to be stated. It must be kept in view apart from all other ages or horizons of oil, whether later or earlier in order of geological time. I have no doubt that some of the petroleum flowing or pumped from old salt wells in South-western Pennsylvania comes from this horizon of No. XII. The rock itself is full of the remains of plants, from the decomposition of which the oil seems to have been made. I noticed in the great rock pavement, at the Lyon's Well, over which the creek water flows, many sections of tree branches and stems, mashed flat, each section being, say 6 inches long by  $\frac{1}{8}$  inch wide in the middle; and when a jack-knife was thrust down into the slit, so as to clear it of mud, the black tarry oil would immediately exude and spread itself over the water. A pointed hammer spalling off flakes of the rock on each side, showed not only that the slit itself was full of thick oil, but that the whole rock was soaked with it, except along certain belts (an inch or less wide and very irregular), which, for some unexplained reason, remained free from the oil.\* Similar specimens of "oil-rock" were obtained in other parts of the valley, and may be got almost anywhere. Mr. Lyon was so much impressed with the quantity of petroleum thus held permanently by the sandrock itself, apart from the immediate

\* My specimens still show this very remarkable peculiarity, although I have had them in a dry, warm room for weeks.

presence of the plants, that he actually erected a powerful rock-crusher, and sunk a shaft, by blasting 38 feet, intending to drift in the directions in which he found the saturation to prevail, and to distil the rock after it had been reduced to powder. Of course such a project was most unprofitable; but it well illustrates the abundance of the petroleum held by the friable sandrock. Some of the great blocks of rock which have fallen from the cliffs too recently to be as yet decomposed, are literally full of the marks of the broken macerated driftwood of that period. For hundreds of square miles this vast stratum of ancient sea-sand is a thick packed herbarium of coal-measure plants. My brother, in his report of the counties further west, writes:\* "Thin streaks of coal are jammed in between the layers of the base of the Conglomerate, and even inlaid in the heart of the solid rock, all along the line." But if the loose sands of the banks of Paint Creek, derived, as they are, from this sandrock, can at the present day receive and retain vast quantities of petroleum, in spite of the perpetual washings to which they are subjected, we can easily conceive of the wide, flat sandy shores of the coal islands of the ancient Archipelago of the coal era becoming completely charged with the decomposed and decomposable reliquæ of both the plants of the land and the animals of the sea.

The Conglomerate is very irregular in its internal composition, or "false-bedded," even to angles of  $15^{\circ}$ , or more. Instances are given below, taken from near Davis's House. Under the rock in Fig. 7 Davis's principal oil

Fig. 7.

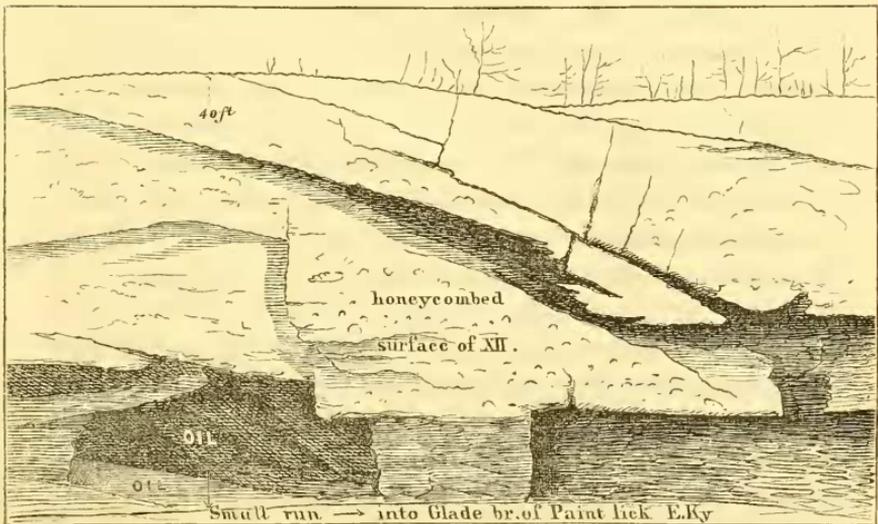


\* K. R., Vol. IV, 1858, p. 454.

spring issues, as shown in Fig. 9; it formerly oozed from *x*. The whole lower, shadowed, or overhung portion of the rock, in Fig. 8, exudes oil from its false-bedding joints, as if these surfaces had received and preserved an extra quantity of the organic matter.

The Conglomerate is, however, still more irregular in the thickness of the whole mass, as was demonstrated on a large scale in 1857 and '8, by Joseph Lesley's survey of the west edge of the coal area, from the Ohio River to the Tennessee State line. He carefully measured the thickness of the sand-rock No. XII, and the shales below it, No. XI, in every county through which the survey passed. On the Ohio River, XII is 90 feet thick, over a few shales, with a thin coal-bed. On the North Fork of Licking, XII is 150 feet thick, over only 8 feet of shales, "with a well-defined bed of iron ore and a foot of coal." On Miner's Fork, 148 feet of XII lies directly on the limestone. In Estill County, XII is 196 feet, over 50 feet of XI shales, with a workable ore-bed and 27 inches of coal. At Standing Rock, XII is 210 feet, over

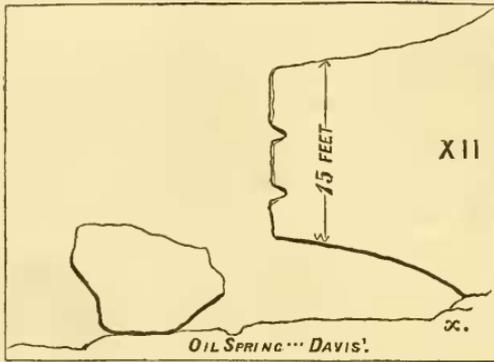
Fig. 8.



50 feet of XI. From this on, southwards, XII is never over 80 feet thick, while the XI shales increase to 225 feet, with two workable and three thin coal-beds, with three distinct ore

shales.\* At Proctor, XII is only 60 feet, while the XI shale mass is even 296 feet thick.†

Fig. 9.



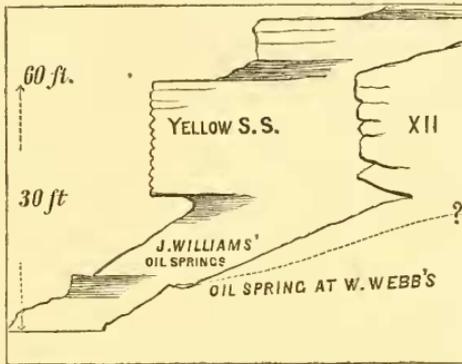
Now I measured the cliffs on Paint Creek in many places, and found the most striking variations. At Davis's, XII is 230 feet thick, the whole of it visible, in a wall composed of two members. Sometimes an upper unbroken wall, of 50 or 60 feet, is retired a little behind the lower and still more massive wall, which rises directly from the bed of the stream. I shall allude to this division afterwards. But the bottom plate is distinctly seen at the water, and the top plate forms perfectly level overhanging eaves to the gorge, on both sides. Only four or five miles above Davis's, at Wash. Webb's fording, the top plate of XII is only 85 feet above the water, and an oil spring issues 10 feet above the water, from under what seems to be the lowest member of XII, 30 feet thick; for at James Williams's, opposite, shales and oil appear. See Fig. 10. At Lyon's place, at the mouth of Open Fork, two or three miles above Webb's, the top plate of XII is 140 feet above the creek; and although the water runs over sandrock, yet shale is struck a few feet down in the well, and the sub-carboniferous limestone at a lower depth; while the rocks are normally horizontal up stream, and the ore and coal shales of XI are visible half a mile distant in that direction. I have not the least doubt of the rapid variability of No.

\* Kentucky Report, Vol. IV, p. 454.

† Idem, p. 478.

XII. And this accounts for the great variations in the aspect of the valley at different places, the appearance and disappearance of cliffs, the commencement and termination of

Fig. 10.



cañons, and the alternate ascent and descent of the margin of arable land upon the hillsides above.

Oil wells, then, if bored in the Paintsville country, or in the upper parts of the valleys of the Paint Creek waters, on the Lewis Survey, cannot calculate on any fixed thickness of No. XII to go through. They may find this mass of sandrock 50 feet thick, or 250 feet thick; and the difference must materially affect their production of oil, supposing the oil to reside in this sandrock, or to be collected at its base.

The division of No. XII into two numbers is also important, because this ought to give two horizons of petroleum instead of one. It is remarkable, that all through Pennsylvania the Conglomerate (No. XII) shows a tendency to subdivision into two or more massive sandrock members, separated by somewhat softer or even soft shaly formations. It is evidently a general feature of its character, produced by some universally acting, still undiscovered cause. But one of its effects is to establish a second line of oil springs at a much higher elevation in the cliffs than the one I have been describing. At Davis's, where the upper member of XII is retired a hundred yards or so, at the top of an intermediate slope, the oil is said to exude at all times as abundantly from

the base of this upper member as it does from the base of the lower member. This is at an elevation of at least 150 feet above the creek.

So, also, under the numerous cascades which the top plate of the upper member of XII makes, for miles up the valley, there are similar exudations, as if the top member was charged, like the bottom member, with petroleum.

*Lower Horizons of Petroleum.*—Under the country of Paint Creek and the Licking waters lie the rocks of the Devonian System, the upper part of which is the well-established horizon of the N. W. Pennsylvania oil, and the lower part of which is the equally well-known horizon of the Canada and Michigan State oil. If we can get, therefore, the thickness of measures between the bottom of the Conglomerate, No. XII, and the top of the Devonian Formation, and also the thickness of the Devonian Formation itself, we can approximate to the calculations of the normal depth of oil wells, if bored to reach, first, the Pennsylvania oil, and secondly, the oil of Canada.

This, then, is the first question:—How deep should the Lyon Well, or the Hinckley Well, or the Spradley Well, or any other well starting from the bottom of the Conglomerate, descend, to strike the upper face of the Devonian Sandstone; and how much deeper must it continue to go to reach the Blue Limestone on which the Devonian System rests? When this first question is answered, it does not follow that the oil will be struck at precisely those places in the Devonian System at which it is struck in Pennsylvania, Virginia, or Canada; for that would depend on the continuance, over immense distances, of certain individual oil-bearing rock members of that system. Thirdly, The quantity of oil at any such level will be a local peculiarity, dependent *originally* on the local abundance of organic matter, both animal and vegetable; and, *secondarily*, on the local thickness, coarseness, and general fractured condition of the oil-bearing rock.

To answer this question, it is necessary to state the order of the formations, as follows, descending:—

- XII. Conglomerate Sandrock.  
 XI. Sub-conglomerate, or Lowest Coal Measures.  
 XI. Sub-carboniferous Limestone.  
 X. Upper Devonian (Catskill) White Sandstone.  
 IX. Upper Devonian Red Sandstone and Shales.  
 VIII. Middle Devonian (Chemung) Clay Sandstones.  
 VIII. Lower Devonian (Portage, Hamilton, and Upper Helderberg) Olive Shales and Black Slates, viz.:
- Genesee Slate;
  - Tully Limestone;
  - Hamilton Slate;
  - Marcellus Shale;
  - Corniferous and Onondaga Limestone;
  - Scolarie Grit;
  - Cauda-galli Grit.
- VII. Oriskany Sandstone.  
 VI. Upper Silurian (Lower Helderberg) Limestones:
- Onondaga Salt Group;
  - Galt Group;
  - Niagara Group.

V, IV, III, II, I, it is not needful here to specify.

Enough has been said, perhaps, respecting the Conglomerate; and respecting the No. XI Ore and coal-shale system under it.

No. XI Limestone is the next important formation to consider. Just the reverse of No. XII, and the other sandstone formations, which have their greatest thickness along the Atlantic seaboard, this "Sub-carboniferous Limestone" of the Great West *thins away eastward* (or northeastward) almost to nothing; is scarcely 10 feet thick where it enters Maryland, and not 2 feet thick in Eastern Pennsylvania. But in Southern Virginia it is quite large; and in Middle Kentucky it is twice as thick as No. XII, but, like it, subject to great variations. Only 70 feet thick on Tygert's Creek in Greenup County on the Ohio River, it increases to 400 feet in Clinton County on the Tennessee State line. It is composed of alternating white, gray, and buff-colored layers of rock, varying in quality from the most argillaceous claystone to the

purest limestone. Its lowest strata contain, in many places, large dark green flint pebbles, which seem to have been extensively quarried by the aborigines. Traces of lead are found through its centre beds. The drainage through it is peculiar. The valleys excavated in it are dish-formed, broad, and shallow, and rarely have streams flowing through them; for the waters of the springs above are carried down through sinkholes and cracks in the cavernous limestone, and often reappear only to plunge again and again, before they finally gush out in copious, clear, and never-failing springs, along the junction of its base with the next underlying Knobstone formation, near the mouths of the valleys, as they open towards the Blue Grass country. We have thus valleys which are technically dry, the bottom being a mere series of dry, crater-shaped holes, where cattle graze.\* In Bath County (70 miles west-northwest of Paintsville), the valleys are terraced with two lines of springs, an upper line of warm soft water coming from the coal shales under XII (85 feet thick), and a lower line of cold hard water, issuing from the base of the XI limestone,† 140 feet thick. In Powell County (60 miles west of Paintsville), the limestone is thick and cavernous; sinks and caves are seen on every hand; the cavern roofs fall in and let down the upper ore and coal measures, so as often to balk the miners of their bed, over large areas.‡ On Rock Lick and War Fork, in the north corner of Jackson County (about 45 miles W. S. W. of Paintsville), the great thickness

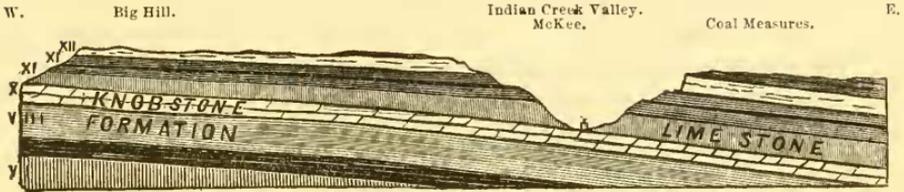
\* Copied in substance from J. Lesley, Ken. Rep., IV, 452.

† Idem, p. 466, 467. See, also, the description under the head of Rockcastle County, page 482.

‡ Ken. Rep., IV, p. 472. Between Roundstone Creek and Kentucky River Valleys, in Rockcastle County, where the Conglomerate XII is very thin, and only in fragments on the upland, a remarkable number of holes occur in it, only to be accounted for by reference to the cavernous nature of the underlying limestone, on which it almost immediately rests, the shales of XI having run down from 240 to 40 feet. The No. XI limestone measuring variously 115, 145, 182, 220, and 240 feet, the last in the southeast corner of the county. The "cavernous" member of XI is described as being about 100 feet down from the top of the limestone. I think it possible that the downthrow (of XII) of 150 feet at Davis's Fording may be due to the same cause.

of both the XI Shales and the XI Limestone will be apparent from the following section :\*

Fig. 11.



It might be argued that this limestone formation is not itself much, if any, concerned in the question of oil, from the fact that the formation is absent in the oil districts of the Ohio River on the Pennsylvania State line; as well as from the fact of its clayey and cavernous constitution, no oil horizon being as yet known in common clay rocks, nor any positive proof having been yet afforded of its collection in caverns so extensive and communicative, and so well drained as those which characterize this formation. But on the other hand, it may be urged: 1, that we do not know to what extent the formation of caverns in it may be confined to the belt of country in which its outcrops permit the cavern-producing waters to escape with their dissolved material; 2, that the Rathbone Well, in Virginia, 700 feet deep, and the Lyon Well, now to be described, both penetrate the limestone, and find in it flows of oil; and its crevices may, therefore, in some regions, play the part of the crevices in the sandrocks which yield petroleum; and 3, that it is crowded with animal organic forms, as can be seen from the following section copied from Mr. Lyon's Report, K. R., Vol. IV, p. 528.

*Section obtained on the 218th mile of S. S. Lyon's Base Line.*

	Feet.
XII. Thick, remarkably false-bedded, fine sharp grit-rock, . . . . .	10
“ Thin-bedded, sharp grit-rock, . . . . .	11
“ Whitish sandy shales, . . . . .	22
XI. Ore beds; and gray shales, . . . . .	2
“ Thin-bedded, buff limestone, <i>indistinct fossils rare</i> , . . . . .	8

\* J. Lesley, K. R., IV, p. 481.

	Feet.
XI. Thin-bedded earthy limestone, <i>Retepora</i> , <i>Archimedes</i> , <i>Pentremites</i> , . . . . .	2
“ Thick-bedded drab limestone, . . . . .	13
“ ? Aluminous and calcareous shales, . . . . .	10
“ Flaggy, whitish oolite limestone; large <i>Pentremites pyri-</i> <i>formis</i> , . . . . .	10
“ Soft earthy buff limestone; irregular angular fracture,	11
“ Semi-oolitic crystalline limestone, producing red soil, .	22
“ Rough concretionary blue-gray limestone, . . . . .	10
“ Gray limestone with buff-colored segregations, . . . . .	2
“ Bright buff earthy limestone; no fossils, . . . . .	4
“ Irregular thin green-gray; no fossils; few chert beds at the top, . . . . .	24
“ Thick-bedded semi-oolitic limestone; top, no fossils, segre- gations and beds of green flint; lower part, <i>Pentremites</i> , <i>Crinoidea</i> , <i>Bellerophon</i> , <i>Fish</i> , . . . . .	22
“ Blue earthy limestone and shales, containing <i>Corals</i> , <i>Spiri-</i> <i>fera</i> , <i>Terebratula</i> , <i>Retepora</i> , <i>Crinoidea</i> , . . . . .	38
“ Soft yellow earthy limestone, . . . . .	56
X. Soft greenish silicious shale (Knobstone), . . . . .	32
“ Hard greenish silicious shale, . . . . .	16
“ Hard fine-grained sandstone, . . . . .	16
“ To the bed of Cow Creek, in all, . . . . .	291

The Lyon Well was bored at the point of Paint Creek, where its South, or Little (Oil) Fork, and its North, or Open Fork, unite. The well-house stands on a plate of rock a few feet above the water-bed. A well was blasted through 20 feet of massive sandrock, under which the auger went down through 2 feet of shale, followed (at intervals not now remembered by Mr. Lyon, whose record of the well is lost) by micaceous sandstone, 33 feet of shale, blue sandstone, white marble, and blue limestone, to a depth of 213 feet.\* Shows

\* The men on the ground told me that 30 feet of blue slate rock was the first bored through, beginning, say, 10 feet beneath the bed of the creek; then a thin but very hard rock. They said that this Belt of slate was struck in the three wells on the creek above and below the Lyon Well, viz., the Donnell Well, bored 200 yards below the Lyon well, and 200 feet deep, the second Lyon Well, and the Warner Well, both near together, about half a mile up the Oil Fork, and 100 to 140 feet deep, quitting in hard rock. In the Lyon Well, they thought they struck a very hard thin rock about 140 feet down, and another 260 feet down, whereupon the auger fell 4 inches, and the gas blew the oil to the surface, and it began to flow. Such details from memory are worth little.

of oil were obtained at 124 feet, 160 feet, 193 feet, and 213 feet. The pump rods came up covered with oil as thick as softsoap, so that a pint of it could be scraped off at a time.\* The oil obtained at 124 feet was of a specific gravity of  $15^{\circ}$ , while that obtained at 213 feet had a gravity of  $30^{\circ}$ .† The limestone and “marble” were tested with acids, and undoubtedly mark the place of the upper layers of the Sub-carboniferous Limestone of XI, which nowhere crops out to the surface in all this sandy country.‡

The depth of the S. C. Limestone below the Conglomerate may be stated, therefore, from the imperfect record of this well, to be 150 feet; which suits the recorded thickness of the Shales of XI, measured further to the westward. The thickness of the Limestone of XI may be reckoned at about the same; so that the Lyon Well would have struck the top of the Devonian Knobstone Formation, if it had been continued to a depth of from 300 to 350 feet.

It is as yet beyond our ability to distinguish the several original sources of the petroleum obtained at different depths from any one well. The specific gravities of the oil decreasing with the increase of depth, is a fact which shows conclusively that a chronic evaporation or distillation of the whole mass of oil in the crust of the earth (within reasonable reach of the surface) has always been and is still going on,§ converting the animal and plant remains into light oils, the light oils into heavy oils, the heavy oils into asphalt or albertite;

\* I saw several barrels of oil in the well itself resting on the surface of the water. There are from 60 to 100 feet of pipe jammed in the hole, as it was dropped by accident when the well was abandoned on account of the unsettled state of the country.

† Mr. Lyon has been a distiller of coal oil, and had a distilling apparatus in his well-house, so that his testimony is entirely intelligent.

‡ It is, no doubt, the “Marble Limestone” of the main street of Mount Vernon, in Rockcastle County, a fine-grained white limestone, much esteemed by limeburners *there*, lying 40 to 50 feet below the top of the formation, and giving origin to a distinct horizon of springs. K. R., IV, p. 482.

§ See my paper on the Petroleum Vein of Northwestern Virginia, published in the Proceedings of the American Philosophical Society, Philadelphia, May, 1863, Vol. IX, p. 185.

the process being accompanied at every stage with the generation of gas. Therefore, the quantities of lubricating oil coming out from the Conglomerate, along the valleys of Paint Creek, prove the existence of immense quantities back from the cliffs in the rock itself, under all the highlands. And for the same reason, the heavy oils obtained first from Lyon's and Donnell's and Warner's wells, followed by lighter oils from a greater depth, prove the existence of yet uncalculated quantities of still lighter oils, at still greater depths; and of a world of gas-pressure which ought to make its presence known wherever there have been rents in the crusts, downthrows, fallings-in, or serious slopings of the stratification; in a word, any sort of natural vent.

Burning springs are instances of this very thing. One on Licking River, 4 miles above Salyersville, the court town of Magoffin County, and only about 12 miles in an air line southwest from the Lyon Well, has been celebrated since the settlement of Kentucky.\*

Another still stronger burning spring exists at a distance of 35 miles in the opposite direction, one mile above Warfield, in the bed of the Tug Fork of Sandy, on the Virginia State line.†

\* This Spring was described to me by Mr. Patrick, whose house (16½ miles from Paintsville by road) stands half a mile higher up the valley. It stands about 15 feet above water-level, in a dry place, the ground being burnt around it. The gas roared continually, and, when fired, would blaze 40 feet high. No oil was known there until a well was bored, from which the principal part of the gas now blows off, roaring and fluttering in it, so as to be audible for one or two hundred yards, scaring timid horses, before the well is within the rider's sight, and distinguishable by the smell for a quarter of a mile to leeward. The rock was found to be fissured in all directions to a depth of 3 or 4 feet, so that a knife could be thrust into the cracks. The auger went through about 150 feet of sandstone, &c., and is said to have got oil at every change of rock, and to have dropped 1½ inches at the end, where oil and water rushed up, so that from 500 to 1000 barrels were estimated to have run off per year. The rebellion put an end to operations. A second well was put down 100 yards distant down the stream, 130 feet deep, more or less, which got oil; and a third well at Patrick's house, 160 to 170 feet deep, which only got a small show of oil with some gas. These are the only wells in the county, except a fourth at the extreme west end of it.

† This Burning Spring is in 15 foot water, the whole of which is kept

These facts alone would suffice to prove the ground under the Paint Creek country charged with gas. But we have nearer evidence.

The Spradling Well, 4 miles up the creek from Paintsville, and 9 miles down the creek from Lyon's Well, on the Mud Fork of Paint,  $\frac{3}{4}$  of a mile above its mouth, blows gas continually, which burns when lit.\*

The whole of this section of Eastern Kentucky is, in fact, an underground oil region. Judge Harris's well, opposite Prestonburg, in Floyd County, 12 miles up Sandy River, above Paintsville, was bored about 600 feet deep for salt, and abandoned on account of the great flow of oil in 1845. The only record preserved was the fact of going through

in a state of ebullition by the gas, which, when fired, will blaze up as high as a man. When the stream is frozen over, holes are broken in the ice to fire the gas. Two wells have been bored in Warfield, 20 rods apart, in one of which the auger dropped 14 inches, at about 300 feet, six years ago, and the poles were greased with the ascending oil. The other well flows oil into the stream. Each gets salt water at about 800 feet. There seems to be a fault across the Fork, which throws the big coal-bed under for nearly 4 miles.

\* D. D. Owen thus describes a burning spring in Clay County, in his Kent. Rep., Vol. I, p. 217, as "a constant stream of gas escaping in copious volumes through a pool of water, in a narrow bottom. A lighted match suffices to set the gas on fire, which flashes instantaneously into numerous jets across the pool, continuing to burn until the gas or a gust of wind blows it out. Judging from the color of the flames and the odor of the gas, it seems to be a mixture of heavy and light carburetted hydrogen with some free or uncombined hydrogen. The commotion in the water rendered it too turbid, without filtration, to test it satisfactorily for its saline constituents. Bicarbonate of iron seems to be its principal constituent. The gases must here reach the surface from some deep-seated source, through an extensive fissure of the rocks concealed by the debris from the hills,—perhaps from some bed of coal or iron ore exposed to surheated steam, or other heat. . . . The elements must be contained in the interior of the earth on a vast scale, since the Burning Spring has continued to evolve these gases with unremitting energy ever since the country was known to the first settlers." Through sand and shales of the coal measures, seven salt wells, yielding 130,000 bushels of salt per annum, penetrate to a depth of 1000 feet, getting brine at 121, 240, 293, and 552 feet; at which last depth the strongest is obtained, the auger dropping into cavities from which the brine, black with a carbonaceous sediment, gushes out, and afterwards grows clear.

black slate. Oil issued also from the Mayo Well, bored about 100 yards distant. These are the only wells in all that valley. On Shelby Fork, of Sandy, in Pike County, oil flowed from a salt well.

It is still doubtful whether the Knobstone formation which immediately underlies the Limestone, is the receptacle of this wide-spread petroleum, or whether we must seek the true horizon in the Blackslate formation which underlies the Knobstone in its turn.

No. X Knobstone formation (consisting of two parts, an upper Sandstone division, and a lower shale division) outcrops in a belt overlooking the Blue Grass country, and measures from 350 to 550 feet in thickness. The upper portion is a thin-bedded, olive-colored, generally fine-grained Sandstone, furnishing good grindstones sometimes, and always building-stone. The lower and larger portion is an olive-colored mud-rock, with pretty generally disseminated nodules of earthy iron ore, from which come most of the Chalybeate Springs of Eastern Kentucky. The upper member seems to correspond to No. X, and the upper half of No. VIII, in which lie the three oil sandrocks of Venango County, Pennsylvania (No. IX being entirely unrecognizable). But the difference of thickness throws us out of all our calculations; for these 350 to 550 feet in Kentucky stand as the representatives for at least 2000 feet in Northwest Pennsylvania, and for 12,000 feet in the Anthracite coal country. The Venango County First, Second, and Third Sandrocks, which have become so celebrated, occupy three horizons in the upper, or as perhaps we should rather call it, the middle part of VIII, lying at maximum depths of 200, 400, and 600 feet respectively beneath Oil Creek Valley bed, but 700, 900, and 1100 beneath the bottom of the Conglomerate, which there caps the hilltops on each side of the Valley. The section represented in Plate II will show this relationship of distances farther down the Alleghany River, at Brady's Bend, where the Conglomerate has reached the level of the Valley bed, and is, therefore, in the same relative position as on our Paint Creek waters. But if, as is pretty certain to be the fact, the Shales

of XI and the Limestone of XI, taken together, are only 300 or 400 feet thick, and the Knobstone is 350 to 550 feet thick, then the top of the black slates under the sandstone *might* be struck at the depth of the *First* Venango Sandrock (700 feet), and certainly would be at the depth of the *Third* (1100 feet), or even of the *Second* (900 feet).

It is evident, therefore, that all reference to the "Three Sandrocks" of the Oil Creek country is useless for countries to the southwest of it, and will be made only by those who are ignorant of the general bearings of the subject.

We can only say, that part of the 350 to 550 feet of Knobstone Form., X and VIII, represents the Oil Creek Formation, and, perhaps, contains one or more like horizons of oil; but whether in one, two, three, or what number of oil-bearing sandrocks, separated by oil-preserving shales, nothing but actual experiment can determine.

It is probable that the wells which penetrate the Limestone XI get their petroleum partly from the Conglomerate above, descending with the drainage waters. But it is still more likely that they get their principal amount of petroleum from the Knobstone Formation below, by a system of fissures similar to that of the Venango Oil region. In any case they are bound to prove productive; and I have not the least doubt that wells, sunk 600 to 800 feet along the Paint Creek Valley, will produce reasonably profitable amounts of Upper Devonian Petroleum, steadily, for an indefinite number of years; and this petroleum will be, of course, light oil, and not the heavy oil of the Paint Creek Valley surface.

The amount of petroleum capable of being held by rocks themselves is far greater than people imagine. They hold it in three ways: 1. By being more or less gravelly and porous throughout; 2. By being cracked in systems of cleavage planes throughout; 3. By being traversed by large fissures, which are, probably, all of them merely enlargements of cracks along the cleavage-planes.

Every foot of gravel-rock may be considered to consist of three-fourths quartz, &c., and one-fourth cavity, cleaned out by long percolation, and now occupied by water and oil.

The proportion which the oil bears to the water in the gravel is unknown, but must be far greater than in the 30 feet of sandrock (taking one of the Venango oil rocks as a base of calculation) at the top of which the gravel lies; for the oil will settle in these top layers of gravel, while the water remains in the body and lower layers of the sandrock. If the proportion in all be 1 to 100 (for the sake of the calculation), the proportion in the gravel may be 1 to 10, and in the few inches at the extreme top, even 10 to 1. If we should suppose only the uppermost four inches of the whole formation charged with pure oil, that would give an absolute layer of oil one inch thick underspreading the whole country as far as the sandrock extends, or about 4000 millions of square inches under every square mile, or, in other words,  $17\frac{1}{3}$  millions of gallons = 551,706 barrels. *Each sandrock* should be able to supply from *each square mile* of its area, the whole present oil produce of the United States for ninety days before it is exhausted, and that without any reference to the accumulation of petroleum in fissures.

Let us carry the calculation a little further, by taking now the fissures into consideration.

The Paint Creek country is one of the most undisturbed on earth. But the drying and hardening to which they are subjected through geological ages crack all rocks; and necessarily in three directions. Two of these directions are always and necessarily nearly vertical, one of them again, being the direction of the primary or master system, going down straighter and deeper, and giving origin oftener to large fissures and downthrows.\*

\* The downthrow at Davis's, the petroleum vein on Hughes' River, and other faults and fissures of magnitude in this part of the Bituminous Coal area, all belong to the same almost east and west system of cleavage-planes observable in the Alleghany River country.

In one great fissure (4 feet wide) of this east and west system on Hughes' River, the Devonian petroleum which underlies the Kanawha country (precisely as it underlies the Paint Creek country) has collected itself and hardened into asphalt, before the Kanawha valleys were scoured out. There stands this vertical, east and west running vein of solid petroleum, an evidence both of the abundance and of the antiquity

All clefts in sandrocks must, as a general thing, remain more or less open; and they are the great channels of rapid underground drainage. Fissures in shaly mudrocks are closed as fast as made by the plasticity of the mass, and by the perpetual percolation of fine clay into them. Those which penetrate coal-beds, for instance, are almost all filled up with clay from the overlying shales; while many of the fissures in the coarser sandrocks are only choked with loose sand or small water-worn pebbles. All these are permanent reservoirs of salt water and oil.

The law governing the number of these cleavage-planes is a simple one; the distance of the clefts from one another is, in the main, proportionate to the massiveness of the strata which they divide; that is, the cleavage-planes of the great beds of massive sandrocks lie much further asunder than those of the thin-bedded sandstones; while those subdividing beds of shale are still closer to each other and more numerous.

The law governing the size or width, and also the length and depth of the fissures, is an analogous one: the great sandrocks exhibit clefts sometimes many inches in width, and running many yards or hundreds of feet continuously. The pressure of these rocks sometimes carries their cracks down (or up) through the softer and thinner beds, and the strain of the dip will even cause these cracks to descend many fathoms below where they originated.

Some of the main fissures are known to be four inches wide. Suppose them to be of all sizes, from four inches to a quarter of an inch in width, and at various distance asunder, from 5 to 50 feet, and to be limited to the sandrock itself, say 30 feet in height; suppose we take the contents of the fissures equal to  $\frac{1}{500}$ th mass of the rock. Now, supposing the oil to occupy but  $\frac{1}{10}$ th of the space in each fissure, the rest being occupied by water and gas, we have a yield of oil

of the Devonian Petroleum. It contains at least 200,000 tons of asphalt (allowing it to go only 600 feet deep beneath the valley which it crosses); able to yield by distillation 178 gallons of refined oil to the ton of 2400 lbs., and therefore over *eleven millions of barrels* of refined oil; a quantity which would allow a Noble and Delamater Well to spout 6000 barrels per day for five years.

from each square mile of each sandrock, in addition to that above, amounting to nearly 50,000 barrels of oil. This is at the lowest calculation. In the case of a well yielding one or more thousand barrels of oil per day, for a year or years, we have only to imagine a single four- or five-inch fissure crossing the upper and lower rocks to a height or depth of one or two hundred feet, and extending a mile or two in length, the oil contents of which will amount to millions of barrels, apart from all side supplies. Along the line of one such fissure, it is easy to see that a dozen first-class flowing wells might last for several years. By ordinary wells it would be practically inexhaustible.

It is not upon these exceptional fissures that the future trade will rely; but upon the myriads of cleavage-planes and cross-cracks which break up the whole crust into cubes, so far as it consists of sandrocks. The number of grand open fissures must be very small; the number of first-class flowing wells is as yet extremely small,—one or two dozen out of five or ten thousand wells in the Oil Creek region. I judge that not more than one well in ten or twelve yields more than one barrel of oil per day. The large majority of the wells must necessarily depend for their supplies upon the slow circulation of the mingled fluids, salt water and oil, forever going on, exhausting and refreshing itself in the porous and cracked body of the sandstone formations. But in this very fact we have a guarantee for the genuineness of the area under discussion as an oil region, the certainty of obtaining petroleum by boring, and the protracted continuance of the supply for many years. All sand and gravel beds are mere sponges, perpetually saturated with oil and water, the mingled fluid being slowly driven towards every available outlet by the gas which is generated with and from the oil. Such spongy rocks must be enormous reservoirs of petroleum, which it is in fact almost impossible for man to exhaust, as I have shown above.

*The Canadian petroleum* occupies a still lower horizon than the Venango County petroleum, the distance between them in New York and Pennsylvania being variously estimated at from 2000 to 3000 feet. Its general relationship to the

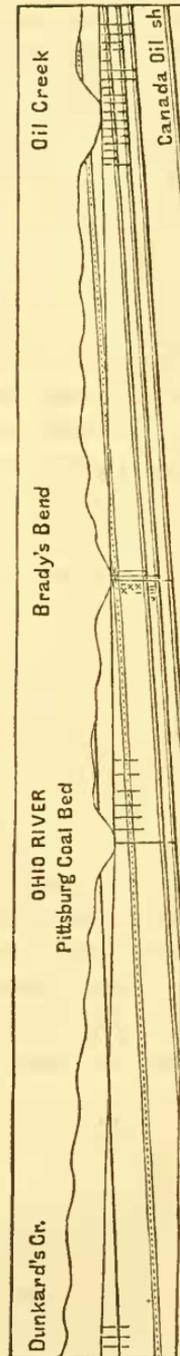
higher horizons is shown in Fig. 12. The Venango oil rocks run up nearly a thousand feet over the level of Lake Erie; the black slates and corniferous limestone of the Canada oil come up from below the bottom of the lake to the north. Wells at Erie strike the oil at 900 feet.

But in Kentucky the black slates of the Canadian oil region underlie the Knobstone formation, and are, therefore, as I have shown, only from 650 to 950 feet beneath the Conglomerate in the bed of Paint Creek.

How far this black slate formation has supplied the Knobstone above it with petroleum, is a question that our science is not at present qualified to answer. But that it is a distinct horizon of oil every one grants. It has yielded copiously in Canada. Several wells, in Middle Kentucky, sunk in it, have yielded a constant flow.\* It is in fact a great deposit of mud, charged with carbon to such extent that many of its layers will burn like coal, and even thin beds of true coal exist in it here and there. These are of course the remains of vegetation. But that they have furnished all the 5, 10, or 15 per cent. of carbon which we find in the formation, is doubtful, in view of the early age in which it was deposited, the abundance of animal life in the limestones under it and in some of its own layers, and the peculiar quality of the Canada oil which proceeds from it or from the limestone under it.

\* In Estill County, one well was ruined by the force of gas. Another, bored by S. T. Vaughn, 405 feet, went through soil 15 feet, black slate 100, light clay limestone 100, gray limestone 190 feet, when the auger dropped, salt water gushed out, and soon gave place to the present constant stream of oil. K. R., iv, p. 472.

Fig. 12.



The total concealment of the Devonian system beneath the Great Bituminous Coal Area, renders it impossible to speculate with confidence upon the details of those changes in its constitution, which we know occur, in passing from its eastern outcrop (along the Alleghany Mountain) to its western outcrop in Ohio and Kentucky. With the exception of the two anticlinals of Chestnut Ridge and Laurel Hill, which, in their passage from Pennsylvania into Virginia, lift above water-level a few hundred feet of the top measures, in the Gaps of Two Lick, Yellow Creek, Black Lick, the Cone-maugh, the Loyalhanna, and the Youghioghany, we are entirely dependent upon oil and salt well boring records for any knowledge of the condition of things in the Devonian underground; how far its salt water and oil-bearing sandrocks extend, each one for itself; the rate at which the intervals diminish in a west-southwest direction; and in what parts of the formation the greatest diminution of thickness takes place.

But, unfortunately, almost all the old records of salt borings are lost; and very few new wells have been sunk by men who knew the importance of keeping any other than a contract account for number of feet sunk. It is impossible to estimate the loss which geology has suffered during the last six years from this reckless ignorance. The inaccessible Devonian strata have been probed by between ten and twenty thousand augers, to depths varying from a hundred to a thousand feet, and no record kept of all that priceless information. It was allowed to flow off into the ocean of forgetfulness, as the oil itself was allowed at first to flow by thousands of barrelsful per day into the Gulf of Mexico. And even now, that men of intelligence have waked to the importance of the fact, most wells are still sunk by contract, without any provision for compelling a careful record of the strata. Nor is there any bureau in the State, any society, or any individual, publicly known to charge themselves with putting to common use, or even with accepting for preservation, what few records are made and kept.

It is with peculiar satisfaction, therefore, that I can publish in the Proceedings of this Society, an authentic record of the deepest recent well in Clarion County, Pennsylvania, and, in fact, the deepest that I know of in the country lying south of Oil Creek Valley. We owe it to the enlightened forethought of one of the master minds of Western Pennsylvania, Mr. Wm. M. Lyon, joint owner with Shorb & Co., of the large Rolling Mill on the south bank of the Monongahela River, and of numerous furnaces and forges in the middle

and western counties of the State. At one of these, Sligo Furnace, on Licking Creek, Piney Township, 10 miles S. S. W. of the county seat of Clarion, and 23 miles in a straight line S. S. E. of Oil City, a well was sunk for oil, which has reached the depth of about one thousand feet, passing through the following rocks :

*Salt Well, Sligo Furnace.*

	Ft.	In.
From surface to rock, . . . . .	14,07	
Soft light-colored slate, . . . . .	22,05	37,00
Black slate, . . . . .	4,07	41,07
Hard sand rock, . . . . .	7,05	49,00
Soft black slate, . . . . .	6,00	55,00
Hard sand rock, . . . . .	6,00	61,09
Sand rock and slate, . . . . .	3,03	65,00
COAL, . . . . .	1,09	66,09
Coarse sand rock, . . . . .	2,00	68,09
Fine hard " " . . . . .	21,05	90,02
Coarse soft " " and water at 128 feet, } XII {	93,02	183,04
Hard slate, . . . . .	10,00	193,00
Soft " " . . . . .	74,08	268,00
Soft red slate, . . . . .	2,00	270,00
Soft sand rock, . . . . .	10,00	280,00
Slate, . . . . .	90,00	370,00
Close-grained blue sand rock, salt 38 per cent., . . . . .	20,00	390,00
Slate, . . . . .	49,00	439,00
Hard blue sand rock and salt, . . . . .	27,00	466,00
Soft slate, sooty substances, with smell of oil, . . . . .	84,00	750,00
Soft red slate, . . . . .	5,00	755,00
Hard sand rock [first Venango rock?] . . . . .	10,00	765,00
Blue slate, . . . . .	21,00	786,00
Red " " . . . . .	29,00	815,00
Blue " " . . . . .	77,00	892,00
Red " " . . . . .	2,06	894,06
Brown " " . . . . .	30,06	925,00
Alternately hard and soft slate, oil, . . . . .	45,00	970,00
Slate, . . . . .	22,06	992,06

Last boring done not measured. The hole is less than 1000 feet.

N. B. The mouth of the well is 175 feet below the Buhrstone Ore-bed level (all the rocks being nearly horizontal); below the ore, 30 to 40 feet, lies the Clarion coal; above the ore, 25 feet, the Kit-tanning coal; above this again, 50 feet, the general surface of the country.

Now it is evident that the mass of sandrock from 68.09 to 183.04, represents No. XII, the Millstone Grit, or Great Conglomerate, 116

feet thick, from the midst of which (128 — 68 = 60 feet below its top layer) there was a flow of salt water. The 74 feet of soft slate under it, and then 2 feet of red slate, seem to represent No. XI. There is no sign of the Sub-carboniferous (XI) Limestone of the West here; although no test for lime seems to have been thought of, and, therefore, the close-grained blue sandrock, 20 feet, may be calcareous. The "red slates," at 750 — 755, 786 — 815, and 892 — 894, look like representatives of Formation IX. The "hard sandrock," 10 feet, at 755 — 765, is the only one in the section which can be considered as occupying a position analogous to that held by the first sandrock of Oil Creek. It lies (755 — 183 = ) 572 feet below the base of the Conglomerate (taken as above at 183), which is more than 100 feet less than its observed distance beneath the Conglomerate on Oil Creek; but the discrepancy may be accounted for *partly* by the extra thickness here of the Conglomerate. Neglecting the "sooty substance, with smell of oil" at 750, the first show of oil is at 970 feet, or (970 — 183 = ) 787 feet below the base of the Conglomerate, corresponding to the Second Oil Rock of Oil Creek, which is about 900 feet beneath the Conglomerate. The place of the Third Oil Rock, and principal horizon of oil on Oil Creek, will, therefore, be at least 150 feet beneath the extreme depth to which this well has been sunk.

Mr. Lyon has furnished, also, a complete record of another important well, 891 feet deep, sunk into the extreme upper part of the Devonian Measures, on the Alleghany River, at Freeport, 25 miles above Pittsburg, and, therefore, 50 miles due south of Oil City.

*Strata bored through in Salt Well, on Alleghany River, 25 miles above Pittsburg. Working coal stratum 3'6" thick in the hill, 35 feet above surface at the well.*

		Ft.	In.
Well, through loam and sand, . . . . .	31,,	00	
Rock, blue and hard, . . . . .	0,,	10	31,, 10
Blue sand rock, with 8 to 10" iron ore, . . . . .	16,,	10	48,, 8
Gray sand rock, softer, . . . . .	20,,	06	69,, 2
Blue slate rock, . . . . .	18,,	8	87,, 10
Blue sand " . . . . .	14,,	10	102,, 8
COAL, . . . . .		10	103,, 6
Fire clay, . . . . .	6,,	8	110,, 2
White slate, . . . . .	9,,	6	119,, 8
LIMESTONE, . . . . .	4,,	0	123,, 8
White slate rock, . . . . .	3,,	0	126,, 8
White sand rock, . . . . .	16,,	0	142,, 8
Blue slate " . . . . .	3,,	6	146,, 2
COAL, . . . . .	0,,	6	146,, 8

Fire clay, or white slate rock, . . . . .		21,, 0	167,, 8
Blue sand rock, very hard and fine, . . . . .		12,, 6	180,, 2
Blue slate " with balls of iron ore, . . . . .		10,, 0	190,, 2
Black slate, . . . . .		24,, 0	214,, 2
Blue slate harder, . . . . .		5,, 0	219,, 2
COAL, . . . . .		4,, 4	223,, 6
Fire clay, . . . . .		6,, 8	230,, 2
Blue slate, . . . . .		12,, 6	242,, 8
LIMESTONE, . . . . .	F. L. ?	10,, 6	253,, 2
Fire clay, . . . . .		7,, 0	260,, 2
COAL, . . . . .		3,, 4	263,, 6
Fire clay, . . . . .		2,, 0	265,, 6
LIMESTONE, . . . . .		5,, 0	270,, 6
Fire clay, . . . . .		1,, 6	272,, 0
Hard blue sand rock, fine grain, . . . . .		9,, 6	281,, 6
White sand rock, . . . . .	T. S. ?	37,, 0	318,, 6
Corrected measurement, for stretching and shrinking of			
the rope, to be added, . . . . .		16,, 0	334,, 6
Blue sandrock, with nodules of iron ore, . . . . .	XII ?	89,, 10	424,, 4
Black slate rock, . . . . .		10,, 2	434,, 6
Blue slate " . . . . .		6,, 0	440,, 6
White sand, . . . . .	} XII ? {	18,, 0	458,, 6
Blue slate rock, . . . . .		29,, 0	487,, 6
White sand, . . . . .		7,, 8	494,, 6
Blue slate, soft, . . . . .		3,, 0	497,, 6
Gray sand rock, . . . . .		4,, 0	501,, 6
Blue slate " . . . . .		6,, 0	507,, 6
Hard gray slate rock, . . . . .		19,, 0	526,, 6
Blue rock, 34'00"—very hard, 41'9", . . . . .		75,, 9	602,, 3
Gray rock, . . . . .		39,, 11	642,, 2
Black slate and COAL, . . . . .		3,, 3	645,, 5
Gray sandrock, . . . . .		3,, 9	649,, 2
Blue sand and white, very sharp, . . . . .		8,, 9	657,, 11
Gray sandrock, . . . . .		9,, 0	666,, 11
Blue sandrock, . . . . .		3,, 0	669,, 11
LIMESTONE, . . . . .	S. C. ?	3,, 0	672,, 11
Slate, and nodules of iron ore, . . . . .		28,, 8	701,, 7
Blue sandrock, . . . . .		21,, 11	723,, 6
White slate, . . . . .		10,, 10	734,, 4
Blue sandrock, . . . . .		79,, 09	814,, 1
LIMESTONE (supposed), . . . . .		7,, 08	821,, 9
Blue sandrock, hard, . . . . .		23,, 10	845,, 7
White sandrock coarse, . . . . .		4,, 02	849,, 9
Blue slate, . . . . .		4,, 10	854,, 0
Blue sand, . . . . .		10,, 02	864,, 9
White slate, with iron ore, . . . . .		11,, 08	876,, 5
Light blue sand stone, . . . . .		14,, 08	891,, 1

In the above section, begun in the Freeport Series, it seems necessary to take the 10'6" limestone at 242'—253' as the Ferriferous Limestone of the Clarion Series, and the 37' white sandrock at 281'—318' as the Tionista sandstone. The Conglomerate, No. XII, will then be represented by the 89' of "blue sandrock with nodules of iron ore," or the two "white sands" further down, or by both, in which last case, we have a total thickness of XII ( $494 - 334 =$ ), 160 feet. From this to the bottom of the well is ( $891 - 494 =$ ) 400 feet; not enough by 200 or 300 feet to reach even the first of the Venango County oil sandrocks. But in these 400 feet we see black slate and coal (at 645), and limestone (at 672), apparently representing the sub-conglomerate coal shales and sub-carboniferous limestone of Kentucky, No. XI. Thick strata of so called "blue" sandrock, seem to take here the place of No. X; and the bottom of the well may, perhaps, with propriety be said to stop in the upper layers of VIII. Everything depends upon the rapidity with which the Devonian and Sub-carboniferous formations are thinning in their course, southwestward, from Northern Pennsylvania towards Kentucky. The coarse white sandrock at 845—849 must be observed.

It is at Tarentum, near this section, and on nearly the same level with it, that the old salt-wells were so much tormented with oil, that their proprietors contracted for its constant removal with Mr. Samuel M. Vier, of Pittsburg, seven years before Dwight struck oil at Titusville. From his skinning of these wells, Mr. Vier made what he called "carbon oil," which he refined by a process of his own, and sold quietly with the camphenes and burning fluids of the East, until it won the market. At first his oil was sold in twenty-five cent bottles as a medicine; and then as an oil for lamps. To Mr. Vier, who had made a large fortune, and retired from the field at its beginning, the oil-well excitement was, of course, a matter of great amusement. But the history of his process is the best illustration we could have of the permanent supply to be expected from those Alleghany River wells which penetrate deeply enough the Devonian measures.

Mr. Lyon furnishes the record of one more well still further south, and only 354 feet deep, and entirely in the Coal Measures, which, however, ought to be preserved, continuing, as it does, upward to the water-level at Pittsburg, our knowledge of the minutiae of the Palæozoic column, from otherwise inaccessible depths, to where it can be studied in the open air. The absence from this section of any

thick coal-bed, corresponding to the large coal-beds of the Freeport series, is very remarkable.

*Record of Boring at Superior Iron-works at Manchester, adjoining Alleghany City, opposite Pittsburg, McClure Township, Alleghany County, Pennsylvania.*

Material.	Ft.	In.	Ft.	In.	Material.	Ft.	In.	Ft.	In.
Surface, . . . . .	14		14		Blue clay, . . . . .	13	2	187	6
White hard slate, . .	10	6	24	6	Dark slate and fire clay,	9	10	197	4
Hard free stone, . .	3	6	28		Dark slate, . . . . .	8		199	4
Soft black slate or shale,	8		36		Slate and fire clay,	8	6	207	10
“ with streaks sulphur,	14	3	50	3	Quartz, . . . . .	1		207	11
Soft dark sandstone,	1		51	3	Slate with hard ribs,	8		215	11
Hard “ . . . . .	1	2	52	5	Hard white cry'd slate,	17		232	11
Dark slate, . . . . .	9	1	61	6	COAL, . . . . .	10		233	9
Dark fire clay, . . .	9	62	3		Fire clay, . . . . .	4	3	238	
Light slate, . . . . .	3	2	65	5	Hard crystallized slate,	2		240	
Fire clay, . . . . .	7	66			Soft fire clay, . . . .	4		244	
Dark slate, . . . . .	1	6	67	6	Soapstone, . . . . .	5	6	249	6
Slate with hard rib,	9		76	6	Fire clay, . . . . .	4	6	254	
Fire clay, . . . . .	5	4	81	10	Hard clay rock, . . . .	11		265	
Sandstone, . . . . .	1	2	83		Dark slate, . . . . .	9		274	
Fire clay, . . . . .	7		90		Hard light slate, . . . .	1	6	275	6
Blue slate, . . . . .	2	10	92	10	Dark slate, . . . . .	2	6	278	
Free stone, . . . . .	2	2	95		Dark sandrock, . . . . .	3	6	281	6
Light blue slate, . .	17	6	112	6	“ hard and soft ribs,	4		285	6
Dark clay, . . . . .	5	3	117	9	White sandrock, . . . . .	1	6	287	
COAL, . . . . .	1	9	119	6	Hard “ . . . . .	2		289	
Blue clay or slate,	8	6	128		Dark “ . . . . .	25		314	
Fire clay, . . . . .	18		146		Wild coal, . . . . .	4		314	4
Sandstone, . . . . .	8	4	154	4	Black shale, . . . . .	3		317	4
Fire clay, . . . . .	2		156	4	Fire clay, . . . . .	9		326	4
Hard sandstone, . .	2		158	4	Slate, . . . . .	4		330	4
Poor iron ore, . . . .	6	158	10		Dark clay rock, . . . . .	10		340	4
Dark slate, . . . . .	3	6	162	4	Hard dark sandrock,	2	8	343	
Dark sandstone, . .	10		172	4	Dark slate, . . . . .	11	2	354	2
Very hard “ . . . . .	2		174	4					

Mr. Chase has obtained the following record of a Salt Well bored in 1840-1, at Latrobe, in Westmoreland County, on the Pennsylvania Railroad, 30 miles east of Pittsburg. It is called Saxman's Salt Well, and has been long abandoned. The Pittsburg Coal-bed, 8 feet thick, lies 10 feet above the level of the mouth of the well :

Soil, &c., . . . . .	15 feet.
Slate rock, blue, soft, . . . . .	1
Sandrock, blue, close, 3; somewhat softer, 3, . . . . .	6
Slate rock, sandy, blue 2; slate, blue, 5, . . . . .	7
Sand rock, blue, 7 (white flint 2 inches), . . . . .	7
Black, slate-like COAL, 1'10, . . . . .	2 = 38
LIMESTONE, with some ore and mud veins, . . . . .	19
Slate and sandrock, mostly blue, some almost black, silvery sand came up, gas vein struck at 85, 10, which boiled for two hours and then stopped, . . . . .	69 = 126

COAL, "8; black slate, "20; black limestone, "20; black slate, 3; dark limestone, 1; . . . . .	8
Slate, blue, 5'8; limestone, 1; . . . . .	7
Sandroek, hard, 5'4, . . . . .	5 = 146
Sand slate, blue, 40; sandrock, blue, soft, 8; hard, 12; hard and black, 13; dark blue, 10 ( <i>gas vein struck at 229'2, strong</i> ); coarse-grained, blue, soft, 1; blue and shaly, some black specks, 29, . . . . .	113 = 259
Slate, hard, blue, rocky, 9; soft, blue (some black), 26, . . . . .	35 = 294
Sandroek, dark blue, hard, . . . . .	4
Slates, blue, brownish, and black, some like hard coal, . . . . .	28
Slate, blue mixed with limestone, . . . . .	2
LIMESTONE, hard, free, with some sand, . . . . .	5 = 333
Slate, blue, 4; red, like kiel, 14; soft blue (soapstone), 5; dark, some sandy, 11; . . . . .	34 = 367
LIMESTONE, black, mixed with ore, . . . . .	1
Slate, dark blue, sandy, . . . . .	2
COAL, "16, . . . . .	1
Slates, blue, some sandy, 37'8; blue and red, 2; red kiel, soft, 15; blue, becoming sandy downwards, with some hard layers, 11; and some salt water at 430 (at 428 hard shells, resembling white flint), . . . . .	66 = 437
Slate, sandy, hard, blue, . . . . .	16
Sandroek, soft, almost black, 8; close-grained, hard, blue and black, 23; very hard, blue (the hardest yet struck in the well), 4; salt water increasing gradually from 465 to 475 feet, . . . . .	35 = 488
Slates, blue and black, with two thin layers of hard sand, 12; alternations of slates and sandrocks, 15; sandrock, blue, with hard shells, 6; . . . . .	33 = 521

This should bring us nearly to the Freeport Series, or top of the Lower Coal Measures. The hard "shells," or crusts of white flint, found at different depths in this, and many other wells, and broken by the auger-bits only with extreme difficulty, are deserving of particular investigation. They seem to form impervious sheets of precipitated silica, effectual barriers against any general movement, upwards or downwards, of the underground drainage. The red clays (kiel) at 347 and 417, are the two "Red Bands of the Barren Measures." The coal at 370 lies between them; and its place is in the hillside at Pittsburg, not far above the mouth of the Manchester Well, last given.

By a combination of these four records, therefore, we have a complete section of strata extending from the Great Pittsburg Coal-bed down through the Barren Measures, Lower Coal Measures, Great Conglomerate, No. XI or Lowest Coal Measures, Sub-carboniferous Limestone, No. X sandstone, No. IX red shale, and the Devonian shales and soft oil-bearing sandstones of No. VIII.

A letter announcing the death of Prof. C. C. Rafn, at Copenhagen, October 20, 1864, was received from Mde. Rafn, dated November 30, 1864.

Donations for the Library were received from the Imperial Academy and Geological Institute, at Vienna; the Horticultural Society, at Berlin; the Royal Academy, and Royal Observatory, at Bruxelles; the London Geological and British Meteorological Society, Trübner & Co., Massachusetts Historical Society, Harvard College, Dartmouth College, New Bedford Public Library, New Jersey Historical Society, Historical Society of Pennsylvania, Franklin Institute, C. H. Hart, Pennsylvania State Library, at Harrisburg; Girard College, Eastern Penitentiary, Blanchard & Lea, Dr. Wood, and Mr. Lapham of Milwaukee.

A copy of Transactions, Vol. XIII, part 1, was laid on the table.

The death of several members, never reported to the Society, was communicated in a letter to the Librarian from Dr. Asa Gray, of Cambridge, viz.,

Edwin James, of Albany, died about 1863.

John Davis, of Boston.

Dr. D. F. Eschricht, of Copenhagen, in 1863, or 1864.

Mr. Chase communicated a short vocabulary of well-established Copto-Egyptian words, to be used conveniently by scholars. This Vocabulary is compiled almost exclusively from Bunsen's "Egypt's Place in Universal History."

Abode, aa; aft; ha.

Abominable, bt; btn-nu; btf.

Above, hr; hri; ʒaa.

Abydos. Abut.

Abyss of waters, un nu.

Accompany, bs; stku?

Aequaint, rz; han; hno.

Aere, ar.

Addle, st.

Address, n. as.

Adhere, tka.

Adherer, the, taki.

Adjust, hp; ʒʒ.

Adore, bz; han; hk-nu; sb; sns.

Adorn, fakr? an.

Afflict, ʒm.

Agree, maht.

Air, nif.

Alauda Calandra, bhū.

Alive, anʒ; aneʒ.

All, nb.

Also, au; ha; ki.

Altar, ʒa; ʒaui; ʒau; ʒaiu.

Always, nhh.

Amber? s-ʒbt; ʒsbt.

Ammon. Amn.

- Anas leucocephala, bs-bs.  
 Anath. Anaitis. Anta.  
 Anchor, to.  $\chi$ sf.  
 And, v. Also.  
 Anger, kant.  
 Angle, kan.  
 Anklets, ar; mn-nfr.  
 Annihilate,  $\alpha$ m;  $\chi$ m.  
 Anointed, hrhu.  
 Another, ki.  
 Answer, ufb. [ $\chi$ s;  $\chi$ tran.  
 Antelope, ar; al; mat-ht; nuhu;  
 Ape, aani; ani; kaf.  
 Appear, har; hn; hr; ptr; 'un.  
 Appearance, an; an-nu.  
 Applaud, hs.  
 Appoint, t $\chi$ .  
 Approach, amn; ar; as; shr; u;  
 Approved, stp. [ $\chi$ nt.  
 Apron, basu; fnti.  
 Archer, ma $\chi$ ; m $\chi$ a.  
 Ardea Nycticorax, ru $\chi$ au.  
 Arm, n. aa.  
 Arm, fore, mn; mnmn.  
 Arrange, fm.  
 Arrive, mna.  
 Arrow, sr, st.  
 Arrows, bundle of,  $\chi$ rf.  
 Arura, v. Aere.  
 As, m.  
 Asp, mhn.  
 Ass, iu; naa; st.  
 Assemble, s-sah.  
 Assembly, saah.  
 Assistant priestess, ah-i.  
 At,  $\chi$ r.  
 Attack, rutn.  
 Authority, sub.  
 Avenge, nt.  
 Avoid, tm.  
 Axe, akah.
- Back, n. pst.  
 Back, to look, annu.  
 Bad, bt.  
 Bag, arf; mru.  
 Balance, n. ma $\chi$ a; v.  $\chi$  $\chi$ .  
 Balsam? baka.  
 Barge of Socharis, hni. See Boat.  
 Barley, bt; nap; napr; su;  $\chi$ n.  
 Base, v. Bad. Abominable.  
 Basilisk, ara; hara.  
 Bat, st- $\alpha$ m $\chi$ mu; takai.  
 Battle-axe, aka;  $\chi$ tn-i.  
 Be, ar; au; pu; r; tr; un.  
 Bean, auru.  
 Bear, atp; fa; kr; pa-pa; ta; tam;  
 Bear off, s- $\chi$ p. [ $\chi$ n; nun.  
 Beard, mrs.  
 Beast, bs.  
 Beast of chase, ba-su.  
 Beat (strike),  $\chi$ i- $\chi$ i.  
 Beauty, an; an-nu.  
 Bee, ht.  
 Beg, ks.  
 Beget, ms.  
 Begin, -ning, ha.  
 Behind, ns; nsu; sba.  
 Being, un. See Be.  
 Below, kar.  
 Bend, kan; kna; sna.  
 Beneath. See Below.  
 Beseech, rtb; ks.  
 Besides, haru.  
 Between, uta.  
 Bier, aa.  
 Bier, to deposit on, s-tr.  
 Bind, arf; hak; hmsa; mr; sak;  
 Bird, hp. [s-ka; snh; sn-n; ark.  
 Bitumen, sf-t.  
 Black, kam; nhsi.  
 Bless, ama $\chi$ .  
 Blood, snf.

- Blow, to, nif.  
 Blue,  $\chi$ sbt.  
 Boar,  $\chi$ aa; fau; rru.  
 Boat, tpt; ua; ba; ta; mna.  
 Boats of burden, us $\chi$ .  
 Boat, to go by, ta.  
 Boat, to tow, mna.  
 Body, a.  $\chi$ a.  
 Boiling, ubt.  
 Bolt, to, s- $\chi$ ; fm; kar.  
 Bombicillo, suru.  
 Book, fa.  
 Born of, af; au; ms;  $\chi$ aa. Prof.  
 Lesley has noted the Japanese analogues, musuko, *son*, musmay, *daughter*. Cfr. Y. ako, *male*.  
 Born of, to be, aa.  
 Bow, v. bka; rs.  
 Bow the forehead, thni.  
 Bow, n. pt.  
 Bow-legged, tn-rat.  
 Bow-case, kr $\chi$ .  
 Box, n. han; tb;  $\chi$ n-nu.  
 Boy, aat.  
 Bracelet, mn-nfr; ar-t.  
 Brass,  $\chi$ nm.  
 Brazier, rkh.  
 Bread, fa; ak; at; hpt.  
 Break, skar; tnru.  
 Breast, kan;  $\chi$ n; s- $\chi$ m.  
 Breast, female, mnt.  
 Breast-plate, utau.  
 Breath, fu-ti; nif. See Blow.  
 Breath, to give, sns; srk; slk.  
 Breathe, srk; ssm; s-sr; ss.  
 Brick, tb.  
 Brilliancy, ui (D.wi).  
 Brilliant, to be, nn.  
 Bring, bs; nun.  
 Bring forth. See Produce.
- Bristle (of eyebrow), an.  
 Broad, us $\chi$ .  
 Brother, sna.  
 Bruise, tr;  $\chi$ m.  
 Buckle, mh $\chi$ .  
 Build, at; atn; kat; se-men $\chi$ .  
 Bull, ka; tpak?  
 Bulwark, n $\chi$ m.  
 Bundle of arrows,  $\chi$ rf.  
 Burn, rkh; tau.  
 Bushel, fa.  
 Butt, to, ab.  
 By, am; an; m; r.  
 Cabin, maat; sk; sbkt; iti.  
 Cackle, kaka; nkaka.  
 Cake, snt; tp; tpt;  $\chi$ a.  
 Calasiris, kr $\chi$ r.  
 Calf, ab; hu; mas.  
 Call by name, rnu.  
 Camel, kamr.  
 Camelopard, sr.  
 Cap,  $\chi$ nr.  
 Cap, to, bn-bn.  
 Capsize, s- $\chi$ t.  
 Capture, kf; kfa; puka; sf $\chi$ .  
 Carpenter, to work as, akk; kk.  
 Carry, fa; ta; tam.  
 Carve, bak.  
 Case,  $\chi$ r.  
 Casque,  $\chi$ nr.  
 Cat,  $\chi$ ai;  $\chi$ au; tsm?  
 Cattle, mn mn.  
 Cave, cavern, hu, tph.  
 Ceiling, hai.  
 Cell, r.  
 Centipede, rrk.  
 Ceremony, b $\chi$ ; u $\chi$ .  
 Chair, hrs; kani.  
 Chamber, as.  
 Chaplet. See Crown.  
 Chapter, r.

- Charadrius armatus, tut.  
 Chariot, markabuta; 'urri; hrri.  
 Chase. See Capture; Beast.  
 Chastise, af; ufa.  
 Cheat, *n.*  $\chi$ ab.  
 Cheese? sr.  
 Chest, tba; tn-nu;  $\chi$ m; kara.  
 Chew, kaka; snm.  
 Chief, asi; ata-i; ha; sr; ti;  $\chi$ aa.  
 Child, rr;  $\chi$ art;  $\chi$ n;  $\chi$ r; frau.  
 Chimæra, ba; sak.  
 Chisel, to, bak; rk; srta.  
 Circuit, mr.  
 Clasp? an-ka.  
 Claw, aka.  
 Clay, ha.  
 Clear,  $\chi$ sr.  
 Clip, tha.  
 Clod, a-t.  
 Clothe, lbs;  $\chi$ bs.  
 Club. See Mace.  
 Coffin, kara; karas.  
 Coitus, sta.  
 Colchicum, mnh.  
 Collar, habuir; mna; m $\chi$ t; us $\chi$ ;  
 Collect, u; s-ka; sha. [ $\chi$ bu.  
 Come, ai; a; i; i-u; maau; mai;  
 ma-u; mna; sua; u.  
 Command, han; han-han; han-nu;  
 Conceal, amn; hap. [tu.  
 Conceived, aai.  
 Conclusion, ark.  
 Condemned, nsai.  
 Conduct, to, tn; tn-nu; mas; ms;  
 Confine, tta. [sta; stkn;  $\chi$ n-nu.  
 Conquer, nrau; ne $\chi$ t; n $\chi$ t.  
 Consecrate,  $\chi$ rp.  
 Consecration, utn.  
 Consent,  $\chi$ tr.  
 Constellation, sah.  
 Construct, kat.
- Contend, kar; kl.  
 Cook, ps.  
 Copper, mafk; mfka.  
 Coracias Græculus, an-heb; kannu.  
 Cords, nuh. See Collar.  
 Corn, bt; bt-i; npa; npa; su.  
 Corn, ear of,  $\chi$ ms.  
 Corn, to stack, usb.  
 Cornelian, an-m-hat ("stone of  
 Cornice? ap-i. [heart").  
 Couch. See Seat.  
 Counsellor, sab.  
 Counterpoise of a collar, man $\chi$ .  
 Cousin, r $\chi$ .  
 Cow, ah; aua; ha; ka; kau.  
 Crafty, sab.  
 Crane, au; ta; utau. See Heron.  
 Create, atn; hm; kam; sapi.  
 Crime?  $\chi$ ta.  
 Crocodile, msuh; sbk.  
 Crook, *n.* au.  
 Crowd, s-ka; sha.  
 Crown, 'urr; 'ur; atf.  
 Crown of flowers, mah; mh.  
 Crown, game of, mhu.  
 Cry out, a $\chi$ .  
 Cubit, mah.  
 Curl, sn-nu.  
 Curse, ns.  
 Cursorius Isabellinus, sth.  
 Cut, bhn; hskā; ki; sf-t; skar; s $\chi$ ;  
 Cut the throat, sf. [tsnu; fat.  
 Cynocephalus. See Ape.  
 Dagger, ba-su; bs-u;  $\chi$ aa.  
 Dance, aba; ks-ks; mk; trf;  
 Dandle, rnn; rr. [ab $\chi$ ;  $\chi$ b.  
 Darkness, a $\chi$  $\chi$ ; akk; kk; u $\chi$ au;  
 Dates, bs; bun; nbs. [krh.  
 Date palm, baka; bs; nbs; bnr.  
 Dawn; Day, ha; har; ra; rhu;  
 Dead body,  $\chi$ at. [at; ht.

Deceit,  $\chi b$ .  
 Deceive, kar.  
 Deck,  $n\chi m$ .  
 Declare,  $r\chi$ .  
 Decorate, bak.  
 Deer, hann; kau.  
 Defending, usr.  
 Deflect, kna.  
 Delight, kam; rf.  
 Deliver,  $\chi np$ .  
 Demon, good, hu-t.  
 Denuded,  $b\chi ta$ .  
 Deplore, nhp.  
 Deposit on bier, s-tr.  
 Deprecate, ssn.  
 Desolate, to,  $\chi ft$ .  
 Despatch, aspu.  
 Detain, pnti; senti.  
 Devastate,  $sf\chi$ .  
 Devil,  $\chi ft$ .  
 Devote, ama $\chi$ .  
 Devour, snm.  
 Devourer, am-t.  
 Diadem,  $\chi a$ .  
 Die, mu; mau.  
 Direct, nm;  $\chi u$ .  
 Disc of sun, a-tn.  
 Disperse,  $\chi anru$ ;  $\chi sr$ .  
 Dispose, sr.  
 Distance, ua.  
 Distinguish, tma; ts.  
 Distribute, sr.  
 Disturb,  $t\chi$ .  
 Divide, uta; a-ka.  
 Divine head-dress, atf.  
 Division,  $p\chi r$ .  
 Do, iri.  
 Dog, uhar.  
 Door, ra; ru; sb.  
 Doorpeg, apt.  
 Drag, sa.

Dragon, app.  
 Draw water? mhi.  
 Dream?  $r\chi$ .  
 Drink, bah; hka; sa; sau; sr;  
 Drip, tf-tf. [shr.  
 Druuk, tha.  
 Duck, apt; bs-bs; ha; hp;  
 kambt; r; s; sr; st; trp;  $\chi pt$ .  
 Duckling, hn-nu; un.  
 Duration, ha.  
 Durite stone, mn.  
 Eagle, a $\chi m$ .  
 Ear, mstr; at.  
 Ear of grain,  $n\chi m$ ?  $\chi ms$ .  
 Earth, ta; tar.  
 East, abt; ibt.  
 Easy, to render, matn.  
 Eat, am; kaka; ust;  $u\chi a$ .  
 Ebony, habn; hbn.  
 Egg, suh.  
 Egypt; "Labyrinth-land," mr;  
 Egypt, Lower, hb. [mr-tar.  
 Eight, ss; fuen.  
 Elbow, sna; kanaa.  
 Elder, 'ur.  
 Electrum? s- $\chi bt$   $\chi sbt$ .  
 Elephant? abu.  
 Elevate, tn-nu.  
 Embalm, kr; tr.  
 Embalment, karas; kas.  
 Emerald? ssm.  
 Enamel. See Electrum.  
 Encase, s'ha.  
 Enclose, snu.  
 End, ark; asf; iuspu.  
 Enemy,  $\chi mi$ .  
 Engrave, rut.  
 Enter, bs.  
 Entrails, kans; kns.  
 Entrance,  $\chi nt$ .  
 Entreat, ks; nini.

- Envelope, namn.  
 Erect, nhas.  
 Escape, tm.  
 Escort, ms; t.  
 Establish, tt; s-mn.  
 Eternal, tta.  
 Evening, rhi.  
 Evil, ban; hu;  $\chi$ as.  
 Exalted, tts.  
 Examine, uts.  
 Excite, nhas.  
 Exist,  $\chi$ aa;  $\chi$ pr.  
 Extend,  $\rho\chi$ t;  $\rho\chi$ ; pt; st; sut-nt.  
 Extinguish, a $\chi$ m.  
 Extremities, ba-ba, ab-ab.  
 Eye, iri.  
 Eye of sun, symbolical, utau.  
 Eyebrow, an-hu.  
 Eyebrow, bristle of, an.  
 Fabricate, ntr. See Make.  
 Face, hri.  
 Facilitate, matn.  
 Fall,  $\chi$ atb;  $\chi$ r.  
 Fan,  $\chi$ aibt.  
 Fashion. See Shape.  
 Father, atf; fat; tf.  
 Fault, asf.  
 Fear, hati; hrs.  
 Feed, uah.  
 Feldspar, green, n $\chi$ m.  
 Festival, hb;  $\chi$ a.  
 Field, ah; ah-a; ha.  
 Fight, kar.  
 Fill, mah; mh.  
 Fillet, hk.  
 Filthy, hu; hs.  
 Finch, an-nbu; sabu; s $\chi$ a.  
 Finger, tb.  
 Fire, sr.  
 First,  $\chi$ rp; fa; api.  
 Fish, to, ham; hm; sn-nu.  
 Fist, kp;  $\chi$ fa;  $\chi$ p.  
 Five, tu.  
 Flabellum, sr.  
 Flame, bs; nsr; ss-i; st;  $\chi$ t.  
 Flax, hma; ma; snti;  $\chi$ nti;  $\chi$ ms.  
 Flesh, ab; af.  
 Flogged, to be, ama.  
 Floor, kaa.  
 Flour, tka.  
 Flow, baba; hbb.  
 Flower, hrr; rnpa. See Crown.  
 Flute, mm; sab; sb; sba.  
 Flute player, sba.  
 Fly, a, af.  
 Fly-flap, smi; sr.  
 Fly, to, ap; a $\chi$ m; fai; pa; pai.  
 Foam, hbt.  
 Fodder, sm;  $\chi$ rf.  
 Fold, kab.  
 Food, hrr; at; hpt;  $\chi$ a.  
 Foot, pti; pts; rt.  
 For, an; n; r.  
 Force, nm; n $\chi$ t.  
 Fore-arm, mn.  
 Forehead, thni.  
 Foreigner, mu.  
 Foreseeing, phti.  
 Form, to, atn; mn $\chi$ ; sapi.  
 Fornicate, nk.  
 Fort, b $\chi$ n; t $\chi$ a;  $\chi$ tu.  
 Fortnight, tna.  
 Found, to, snt.  
 Fountain, hmbi.  
 Four, aft; ftu.  
 Fowls, apt.  
 Fraction, r.  
 Fragrance, tf.  
 Frighten, s-hr.  
 Frog, hk.  
 From, am; an.  
 Frontier, mr; ta $\chi$ .

- Full, to, r $\chi$ .  
 Fuller, r $\chi$ .  
 Funeral chest, kara.  
 Furnace, karr; kll.  
 Future (particle of), au.  
 Game of the crown, mhū.  
 Gap, p $\chi$ a.  
 Garden, rhi.  
 Garland, mah.  
 Gate, sb; sb $\chi$ -t.  
 Gather, sm.  
 Gazelle, aa; ar; htū; kahs; sta.  
 Geese, apt.  
 Gem, am.  
 Germinate, rut.  
 Giant, ap-p.  
 Guild, nbi.  
 Giraffe, srr.  
 Girdle, 'un $\chi$ ; hn $\chi$ .  
 Give, ta.  
 Give breath to, sns; sns-hu.  
 Glass, fbn.  
 Gleam, mau; pst.  
 Glorify, aui; sua $\chi$ ; sbaau.  
 Glory, aaiu; aau.  
 Glow, haha; 'ut.  
 Go, aka; hr; ta.  
 Goat, ba.  
 Go back,  $\chi$ sf.  
 Go before, ha.  
 Go by boat, ta.  
 Go down, pna.  
 Go out; har; hm; uta; uts.  
 Goad, s- $\chi$ b.  
 Goat, abu; ba; ka; htū.  
 God, hakhak.  
 God, goddess, ntr.  
 Gold, nb; nm.  
 Good, nfr.  
 Good demon, hu-t.  
 Goose, smn; sr; apt.
- Gore, t $\chi$ r.  
 Govern, hm.  
 Grain, npa; npra; u $\chi$ m.  
 Granary, sn-ut.  
 Granite, mat-ht.  
 Grapes, arr.  
 Grasshopper, hm.  
 Grease (leather), to, ths.  
 Great, naa.  
 Green basalt, b $\chi$ n.  
 Green feldspar, n $\chi$ m.  
 Green color? tuaut; ut.  
 Grind, tr; nt; nk.  
 Groan, akb.  
 Grow, tar.  
 Gryphon, a $\chi$  $\chi$ ; sfr.  
 Guard, ari.  
 Guard cattle, maan.  
 Guess, tp.  
 Gullet,  $\chi$ bb;  $\chi$  $\chi$ ; bb.  
 Gum wood, kam.  
 Hades, amn-t.  
 Hail! ha.  
 Hair, sn; tam-ua. Lock of hair, n $\chi$ t.  
 Half, tna; m; meti.  
 Hall, arr; nu; us $\chi$ .  
 Hallow, ama $\chi$ .  
 Halyards, nfri.  
 Hammon. See Ammon.  
 Hand, tt. See Fist.  
 Hang, rs.  
 Hare, a $\chi$ a-tr; s- $\chi$ at.  
 Harp, bn.  
 Harrow, hr.  
 Hatches of a boat, maat.  
 Hatchet, akah.  
 Hate, mas; mst.  
 Have, kr.  
 Hawk, a $\chi$ m.  
 He, f; su.  
 He-goat, ka.

- Head, ap; ap-i; ha.  
 Head-dress, divine, atf.  
 Head-rest. See Pillow.  
 Hear, stm; s-at.  
 Heart, har; ha-t; ht.  
 Heart-stone. See Cornelian.  
 Heat, rkh.  
 Heaven, pe.  
 Helmet,  $\chi$ prf.  
 Hemp. See Flax.  
 Her, s.  
 Heron, hnt; kapu; ru $\chi$ an; sns $\chi$ .  
 Hide, a, an-m. [See Crane.  
 Hide, to, hap.  
 High, fa.  
 Hill, hu; tu.  
 Hippopotamus, apt; tb-t.  
 Hoe, tf.  
 Hog, rra.  
 Hold of a vessel, apt; us $\chi$ .  
 Honey-comb, kabi.  
 Horizon,  $\chi$ r; pkar.  
 Horn, ab; ba.  
 Horse, htr; htra.  
 Hour, 'un; 'un-nu; kp; fp; tp.  
 House, a, baita.  
 Hull of boat, tpt.  
 Hunger, hkar.  
 Hunt, kf; kfa;  $\chi$ ns.  
 Hurl, sab $\chi$ .  
 Husband, ha; ka.  
 Hyena, bhui.  
 Hypocrisy,  $\chi$ au.  
 Hypocrite,  $\chi$ ab.  
 I, a; u; nuk.  
 Ibis, hab; hb.  
 Idle, knau; s-sat; ba; sbaat; sk.  
 Idleness, asf.  
 Illuminate, ubn.  
 Illumined, u $\chi$ ; b $\chi$ .  
 Image,  $\chi$ rp.  
 Imagine,  $\chi$ mhu.  
 Impious? asb; sba.  
 Impudent, rka.  
 Impure garments, sf $\chi$ .  
 In, am; m; r.  
 Incense, sntr.  
 Incline, bh $\chi$ ; bka; rk.  
 Increase, tr.  
 Ingot, utn.  
 Iniquity,  $\chi$ bt.  
 Insect, rfrf.  
 Intellect, mau.  
 Inundate? bah.  
 Invert, a $\chi$ ; pna; s $\chi$ -t.  
 Invoke, ufa.  
 Iron? ba.  
 Is, ar; r.  
 Island, mr.  
 It, s; su.  
 Ivory, ab.  
 Jackal, sab; absi.  
 Jasper, kam; ks; kspu.  
 Jet of flame, bs.  
 Join, hpt. To join cords, tka-r.  
 Joy, ha.  
 Judge, to, hp; stm; stp.  
 King, sun-t; sutn.  
 King, sanctity of, hnt $\chi$ .  
 Kiss, mr.  
 Knead, nk; nt.  
 Knee, kan-rat; sna. See Bend.  
 Knit, aa.  
 Kukufa sceptre, tam.  
 Kuphi, tf.  
 Labyrinth, mr.  
 Lady, hm; hma.  
 Lament, aakb; akb.  
 Land, st.  
 Large, us $\chi$ .  
 Lark, ama; bh $\chi$ .  
 Latchet of sandal, th.

- Lay out, smn; sbak.  
 Lead, *n.* th th; thti.  
 Lead along, ts.  
 Leaf,  $\chi r$ .  
 Leap, sp.  
 Length, ua;  $\chi au$ .  
 Libation, htb; kabh; utn-nu.  
 Lie in (with child), papa.  
 Life, an $\chi$ .  
 Light, bka; b $\chi$ ; hai; hi; ht; mau; nu-nu; pf; ubn; ui; un; 'ut.  
 Light, to give, s-ht.  
 Lighten, pf; snk.  
 Like,  $\chi a$ .  
 Likewise, ki.  
 Limb, ha.  
 Linen. See Flax.  
 Lintel, ati.  
 Lion, maau; maui; rabu; labu.  
 Lioness, p $\chi a$ .  
 Lips, spt.  
 Liquids, hka.  
 Listen, at.  
 Little? nts.  
 Live, Living, an $\chi$ ; ane $\chi$ .  
 Lo! as.  
 Load, atp.  
 Loaf, snnu.  
 Lock of hair, n $\chi t$ .  
 Locust, hm.  
 Loins, at.  
 Long, ua;  $\chi u$ . See When.  
 Look back, annu.  
 Lord, nb; tts.  
 Lotus, s'in.  
 Love, mr.  
 Lower Egypt, hb;  $\chi b$ .  
 Lynx, maft. t.  
 Mace, ht; s $\chi u$ .  
 Magus, sab.  
 Make, iri; kaut; kam; kat; nm $\chi$ ; ntr; s $\chi a$ ; s- $\chi ar$ ; tr;  $\chi a$ ; (nhp, to make as a potter).  
 Male, ka.  
 Man, ruma.  
 Manifest, har.  
 Manifold, meh.  
 Mankind, pa; rt.  
 Mansion, ra.  
 Many, hh;  $\chi a$ ; hka.  
 Mare, ssm.  
 Marsh, ah.  
 May, ma.  
 Me, a; u; nuk.  
 Measure, a, han; hpt; mn; tb-h.  
 Measure, to,  $\chi a$ .  
 Meek, 'urt.  
 Men, rt.  
 Metal armlet, mska.  
 Milk, art.  
 Mill (to beat), nt;  $\chi i$ - $\chi i$ .  
 Minister, a, sm-s; sm-sm.  
 Mirror, ma-u; ma-hr; hu-hr.  
 Moistens, harp.  
 Molest, sk.  
 Monkey. See Ape.  
 Monoceros, ramax.  
 Monument, mn.  
 Moon, aah.  
 Mother, mu.  
 Mould, to, sapi; nhp.  
 Mount, ap; ap-a; ap-p.  
 Mourner, hb.  
 Mouth, r; ru.  
 Move, kaa; ak; tnnu.  
 Mow, as $\chi$ ; us $\chi$ ;  $\chi abu$ .  
 Mullet, bari.  
 Mummy, karas.  
 Nails, suh.  
 Naked, to be, haa.  
 Name, rn.  
 Namely, ks.

- Nation, hs-mn.  
 Navigate,  $\chi$ t.  
 Neck, nhb. See Nuque.  
 Negro, nhsi.  
 Nest, s-f.  
 Net, s- $\chi$ t;  $\chi$ t; fna.  
 Night, afru; kar-hu; ufa; fr.  
 Nine, psit.  
 No, am; un; tm;  $\chi$ m; en; nen.  
 Noble, aa; as; atai; sr. [ne.  
 Noose, s-f $\chi$ .  
 North, Northwind, mah.  
 Nose, fnt.  
 Nosegay? ab; ih.  
 Nostril, fra.  
 Not. See No.  
 Nourish, snkaus; sn $\chi$ n.  
 Numerous. See Many.  
 Numidian goat, abu.  
 Nuque of neck, mati.  
 Nurse, mna; sun $\chi$ ;  $\chi$ nm.  
 Nurse's collar, mna.  
 Nursling, rru.  
 Nycticorax, bn; ru $\chi$ au.  
 Oar, usr.  
 Oarblade, hpi; hpt.  
 Oarlock, bas-t.  
 Obelisk, t $\chi$ n.  
 Oblique flute, mm.  
 Obscurity, kk. See Darkness.  
 Ocean, iuma; ht-hr.  
 Odor, st.  
 Of, an; m; n; r.  
 Offer, hpt; ka;  $\chi$ rp; ta.  
 Oh! a; ha.  
 Oil, tat; tt.  
 Olive. See Oil.  
 Omit, sbaat.  
 One, ua; uot. In Coptic, un, to  
 One of a class, rpa. [be, is used:  
 Open, 'un; s $\chi$ ; hn; sn.
- Oppress, ht.  
 Optative particle, ma; mai.  
 Orbit, kar; sn-n. See Bind.  
 Order, to, sr; t $\chi$ -t $\chi$ .  
 Order, in, rta.  
 Orichalcum, ka $\chi$ a.  
 Other,  $\chi$ t.  
 Other things, a $\chi$ t.  
 Overtake, sf $\chi$ .  
 Overthrow, sf $\chi$ ; s- $\chi$ r; s- $\chi$ t.  
 Ox, kau; sab.  
 Packet. See Bag.  
 Paddle blade,  $\chi$ rp.  
 Paint, s $\chi$ a.  
 Palanquin, uts.  
 Palm, date, baka; bnr; bs; nbs.  
 Palm-wine, baka.  
 Palm of hand, kp. See Fist.  
 Panegyry, hakr; hb.  
 Papyrus, tt.  
 Part, r.  
 Pass, sn.  
 Path, hr; matn nu; tr?  
 Peaceful, to be, har; hrt.  
 Pearl, am; an-m.  
 Pectoral plate, utau.  
 Peg of a door, apt.  
 Pendant, utau.  
 Perfume, tf.  
 Peritius, prtis.  
 Persea, the, aft.  
 Person, a, s; pai.  
 Picture,  $\chi$ r.  
 Pigmy, nmm.  
 Pile (a game), ar.  
 Pillow, 'urs; huls.  
 Pint, hpt.  
 Pitch, sf-t.  
 Placable, 'urt. [ $\chi$ n.  
 Place, to, ama; mn; rta; sr; tum;  
 Place, a, aa; hm; ma; nu; fta.

- Plank, p̄ya.  
 Plantation, rhi.  
 Play the harp, s-ka.  
 Play at latrunculi, aasb.  
 Please, rau.  
 Pleasure, rf.  
 Plough, hab; hb; s-ka; χb; χba.  
 Pluck corn, h[u].  
 Polish, snaa.  
 Pollute, tu; tu-tu.  
 Pool; barkabuta; ht; htb; f.  
 Porcelain, fbt.  
 Porphyrio hyacinthinus, shh.  
 Potter's stand, nhp.  
 Pottery, χatab; manχ?  
 Pouch, arf.  
 Pound grain, s-hm.  
 Pour out, htb; 'utb; uah.  
 Power, tam; χfa; fin.  
 Powerful, to be, nχt.  
 Præformant of future, au.  
 Præformant of optative, ma; mai.  
 Prætorium, tb.  
 Praise, sbaau.  
 Pray to, heu.  
 Prayer, as; tb-h; tb-ti.  
 Precede, ha.  
 Precinct, an.  
 Preference, Preferred, sm-s.  
 Prepare, smn.  
 Prepuce, karnata.  
 Present, ht.  
 Pride, tu-tu.  
 Priest, hnt; stm; uab; ab.  
 Priestess, sua. Assistant priestess,  
 Principal, as; χrp. [ah-i.  
 Prison, ra; fta.  
 Prisoner, tnhu.  
 Prisoner, to take, kf; kfa.  
 Privilege, kar; kl.  
 Proclaim, ka; af.  
 Prostrate, bka-bka; tb-tb.  
 Pudendum, baah; karnata; ms.  
 Pure, Purify, ab; rχ; uab; uχ.  
 Purse, arf.  
 Put to flight, pt-pt.  
 Pyramid, br-br.  
 Quiet, to be. See Prostrate.  
 Quit, hm.  
 Race, human, rt.  
 Rage, kant.  
 Raise up, af; nhas.  
 Ram, ff; fft.  
 Rat, pn; pn-nu.  
 Ravish, nm.  
 Ray, st.  
 Ray fish, rm.  
 Reap, asχ.  
 Receive, ka; ra; tp.  
 Reconnoitre, hat-hat.  
 Recurvirostra Avocetta, tm.  
 Red, Red crown, tfr.  
 Red jasper, χnm.  
 Redoubled, kabi.  
 Reeds, aak.  
 Reel, tha.  
 Refresh, kab.  
 Refreshments, hka.  
 Reign, χu.  
 Rejoice, ahaha; ha; ka; sχχm.  
 Relative, a, rχ; kan.  
 Renew, rnpa; rut.  
 Reprobate, χft.  
 Reptile, ttfi.  
 Resemble, χa.  
 Reservoir, f.  
 Resplendent, to be, bn-bn.  
 Resting-place, as.  
 Restrict, χnark.  
 Revolt, tn-tn.  
 Revolter, nhsi.  
 Rhinoceros, ab.

- Produce. See Beget.  
 Prop, sba.  
 Ribs, apt; sph.  
 Rigging, a-tu-kar.  
 Rise up, ap; ap-a; ap-p; ar; azm;  
 River, aru. [thun; tn-nu.  
 Road, hr; matn-nu.  
 Roar, ham-ham.  
 Roast, haha.  
 Rob, kar.  
 Rock, st.  
 Roll, a, s-za.  
 Rope, as; mn-nu; nuh.  
 Rub, tr.  
 Rudder, hm; hua; hms.  
 Ruin, sfz.  
 Rule, hka; mak; zu.  
 Ruler, hk; hka.  
 Run through, fas.  
 Sacred cakes, sn-nu.  
 Sacrifice, ta.  
 Sail, tpak; tkai.  
 Sail to, ta.  
 Saloon, usz.  
 Salt? mrh.  
 Sanctify, hnt; hnt.  
 Sandals, tb-ti.  
 Sandstone, rt; rut.  
 Sarcophagus, kara; tba.  
 Saturn, sb.  
 Save, nhm.  
 Saw, to, us.  
 Scale (balance), maza.  
 Scarabeus, zpr.  
 Scarify, tma.  
 Scent, sna; srk; ssm.  
 Sceptre, kind of? ksm. See Ku-  
 Scimitar, zpz. [kufa.  
 Scolopax, buka.  
 Scorpion, srk; slk.  
 Scrape, s-ka.  
 Scribe, szai.  
 Sculpture, rt; s-rka.  
 Sea, ht; iuma.  
 Seat, kat; hs.  
 Secret, kr.  
 Section, s-zr; zr.  
 See, ma-u; maa.  
 Seed, ka; rt.  
 Seek? znm.  
 Select, stp.  
 Self, ha; ts.  
 Send, tn-nu; zn-nu.  
 Separate, tma.  
 Sepulchre, bu.  
 Serve? ais.  
 Sesamum? ssm.  
 Set over, rpa.  
 Set up, ha; ka; smn.  
 Seth, st.  
 Seven, sfz.  
 Sew, sta; sat.  
 Shades, azz.  
 Shaft of column, pt.  
 Shape, sapi; zpr; tft.  
 Shave, zak.  
 She, s.  
 Sheep, sr. See Ram.  
 Shepherd, mna; fasu.  
 Shield, akam.  
 Shin, mn.  
 Shine, nn; pst; 'un; ubn.  
 Shirt, senti.  
 Shoe-latchet, ths.  
 Shoot, tr; pt; pz.  
 Shoulder, kahu.  
 Show, ptr.  
 Shrine, s-sm; kara.  
 Shut, s-zm; s-f; zt; ztm; ft.  
 Shuttle, nt.  
 Side, bat; sa; spir.  
 Signet, tb-h; mna-t.

- Silver, ht.  
 Sin, ban; hu; fta?  
 Sindon, senti.  
 Sing, hs.  
 Sister, sna.  
 Sistrum, szz.  
 Sit down, bka-bka; hms.  
 Six, sou.  
 Skein, sta.  
 Skin, an-m; bs.  
 Slain, the, htb.  
 Slaughter, tuaua.  
 Sleep, znm.  
 Slice, afr; tsnu; fba.  
 Sling, ts.  
 Smash. See Break.  
 Smell, znm; sti.  
 Smite, sma; zpx; zr; fr.  
 Smith, kara.  
 Snake, hf; rra; ru.  
 Soar. See Rise up.  
 Sofa. See Throne.  
 Soldier, krafr; mata; mnf; mni.  
 Son, iri; s; sba.  
 Soothe, skar.  
 Soul, ba.  
 South, sua; sur.  
 Sow. See Seed, Boar.  
 Spark, tka.  
 Sparrow Hawk, bak.  
 Speak, rz; tt; tu.  
 Sphinx, akr.  
 Spike, sr.  
 Spin, sta.  
 Spirit, pure, rz.  
 Splendor, auu; mau; bz; uz.  
 Sport, abu.  
 Spotted, ab.  
 Sprinkle, pnka.  
 Spy, hap.  
 Stable, ah-a.  
 Stack corn, usb.  
 Stagger, tha.  
 Staircase, arr.  
 Stalk (of corn)? mfa.  
 Stalk along, aka.  
 Stand erect, aha.  
 Stand for vases, s-haa.  
 Star, sb; zab.  
 Starve, hkar; zbni.  
 Statue, tut.  
 Stay, hm.  
 Stead, hbt; senti.  
 Stench, sti.  
 Step, ar.  
 Stern of vessel, hptu; utu.  
 Stibium, smt.  
 Stick, a, szu.  
 Stockade, bz n.  
 Stone, an; bn-nu? st.  
 Stop, fsf; fn-ti.  
 Storehouse, ra.  
 Strangle, hmsa; s-hm.  
 Strap, mss; unz.  
 Straw, tha.  
 Stream, ba-ba; hbb.  
 Strengthen, amaz.  
 Stretch, uha; ps.  
 Strike, h[u]; hu.  
 Strong, nzt; seneba.  
 Struck, fr.  
 Stupefy, tmat.  
 Subdue, sbk; sma; tma; tb; ztb.  
 Substance, ha? maai; au.  
 Suckle, rr.  
 Sue, sns n.  
 Suffocate, akt.  
 Sun, ra.  
 Sun, disk of, a-t n.  
 Sun, symbolical eye of, utau.  
 Sunbeams, ama? st.  
 Sunset, kar.

Sun's orbit, snnu.  
 Supplicate, han-nu.  
 Supply, srk ; slk.  
 Support, nt ; nk.  
 Suspend, az ; rs ; ts.  
 Sustain, uts.  
 Swallow, a, mn.  
 Swan, apt.  
 Swill, bah.  
 Swim, nb.  
 Sword, sf.  
 Sycamore, nh ; nhai.  
 Table, thu.  
 Tablet, ht.  
 Take, nm ; fp.  
 Take prisoner, kf ; kfa.  
 Tamarisk, asr.  
 Tame. See Subdue.  
 Tank, f.  
 Taste, tp ; tpp.  
 Ten, met ; ment ; mnt.  
 Terrify, hat ; hr.  
 Testes, karu.  
 That is to say, ks.  
 The, nai ; p ; pa ; pu ; pui ; ta.  
 Thebes, apt ; ta-ap.  
 Then, as.  
 They, sn.  
 Thigh,  $\chi$ pt ;  $\chi$ pz.  
 Thing, bu.  
 Thirst, ab ; abu.  
 This, pa.  
 Thou, k ; nk ; t.  
 Thread, ball of, sta.  
 Three, famet ; fament ; fomt.  
 Throat, part of, kaf.  
 Throne, kat ; hs.  
 Through, am ; m.  
 Time, tar ; tr ; sp ; sb.  
 Time, some period of, ast.  
 Time (as once, twice),  $\chi$ p.

Tin? s- $\chi$ bt ;  $\chi$ sbt.  
 Tips, ba-ba ; ab-ab.  
 Tip, to, bn-bn.  
 To, ar ; n ; r ;  $\chi$ r.  
 Together with, hna ; hr.  
 Tomb, fta.  
 Tooth, abh.  
 Tortoise, ap $\chi$ .  
 Touch, kah.  
 Tow, to, mna ; sta.  
 Towline, ha-ti.  
 Towards, an ; ar ; r ; fr.  
 Tower, mak ; makataru.  
 Trample, pt-pt.  
 Transfix, tr.  
 Transform? fb-fb.  
 Transport, to, tm ; ts.  
 Transport (vessel), hua.  
 Traverse, sm ; sn ; fas.  
 Tread on,  $\chi$ nt.  
 Treat with, maht.  
 Tremble, stut.  
 Tried (select), stp.  
 True, Truth, ma.  
 Truss of hay,  $\chi$ rf.  
 Try, uts.  
 Tumble,  $\chi$ bt ;  $\chi$ tb.  
 Tunic, s $\chi$ nt ; futi. See Shirt.  
 Turn away, sna.  
 Turn back, fsf ; hm.  
 Turtle dove, mn.  
 Tutor,  $\chi$ mns.  
 Twine, to, mna.  
 Twist, tka-r.  
 Two, snau.  
 Type, ar ; ka ;  $\chi$ pr.  
 Typhon, st.  
 Under, ka ; kar ;  $\chi$ r.  
 Undertaker, hb.  
 Unicorn, ramaz.  
 Unite, hpt.

- Up, to rise, ap; ar.  
 Upon, hr; api.  
 Uræus, ara; hara.  
 Ursa Major, zp̄z.  
 Utensils, menz.  
 Valley, an.  
 Vanquish, nrau.  
 Vase, han; mn; tb.  
 Vessel's hold, apt.  
 Vestibule, zn.  
 Vex, hs.  
 Viand, ab.  
 Victorious, akar.  
 Victory, kan; kan-nu; nsr; ssr.  
 Vigilant, ph-ti.  
 Vine, arp; arr.  
 Violate, zb.  
 Violence, to use, nm.  
 Vulture, nrau.  
 Walk, ūn.  
 Wall, mr? sb.  
 War chariot, 'urri.  
 Warlike, akar.  
 Warp a boat, mna.  
 Wash, aa; rz; iua.  
 Wash gold, nkbt.  
 Wasp, zb.  
 Waste, to lay. See Devastate.  
 Watch-tower, mak; makataru.  
 Watchful, ph-ti.  
 Water, mah; muau; nm.  
 Water for washing, aa. Abyss of  
 Wax, mrh. [waters, mnuu.  
 Weep, Weeping, nhp; rm.  
 Weight, tb-h; tz.  
 Wells, utbu.  
 Wet-nurse, mna.  
 Wheat. See Corn.  
 When, rta; fin.  
 Whetstone, an.  
 Whilst, m[n]z-t; tr.
- Whip, zz.  
 White, abf; ht.  
 Wicked, bzta? n̄ni? sb; sba.  
 Wife, hm; hma.  
 Wind, nif.  
 Windpipe, ah-i.  
 Wine, arp.  
 Wing, mah; tuh.  
 Winged disk, zpi.  
 With, am; hna; hr; kar; m; n; zr.  
 Witness, ma-t-ra.  
 Wolf, hunfa.  
 Wood, ba; fa.  
 Wood, a kind of, apt.  
 Wool, an-m.  
 Work, bak; tr.  
 Work as a carpenter, kk; akk.  
 World, ta.  
 Worm, fnt; rf-rf.  
 Worship, tua; hati.  
 Woven things, szta.  
 Wrapper, tba.  
 Wretched.  
 Write, szai.  
 Yellow; Yellow jasper, ant; anti.  
 Yellow paint, pst.  
 Yesterday, sf.  
 Young, hn-nu; rupa; 'un-nu.  
 Youth, rnpa; rpa.  
 Youthful, zr.
- 
- a, I; me; a house; oh!  
 aa, to knit; to wring out; to be born  
 of; to wash; water for washing;  
 an arm; a gazelle; a noble;  
 place; abode; noble; bier.  
 aah, moon.  
 aai, conceived.  
 aaiu, glory.  
 aak, reeds.

- aakb, to lament.  
 aani, ape.  
 aasb, play at latrunculi.  
 aat, a boy.  
 aau, glory.  
 ab, flesh; viand; thirst; a nosegay;  
     to butt; a horn; ivory; rhinoce-  
     ros; calf; pure; to purify; spot-  
 aba, to dance. [ted.  
 ab-ab, to butt; horns; extremities.  
 abh, a tooth.  
 absi, jackal.  
 abt, the East; a month.  
 abu, a Numidian goat; an elephant;  
 abut, Abydos. [thirst; to sport.  
 abz, to dance.  
 abf, white.  
 af, flesh; born of; a fly; to chas-  
 aft, an abode; four. [tise.  
 ah, a cow; field; marsh.  
 aha, to stand erect; field; a stable.  
 ahaha, to rejoice.  
 ah-i, assistant priestess; windpipe.  
 ai, to come.  
 ais? to serve.  
 ak, bread; to move, go.  
 aka, a claw; to go, stalk along; to  
 akah, a hatchet. [divide; battle-axe.  
 akam, a shield.  
 akar, warlike; victorious.  
 akb, to groan; lament.  
 akr, sphinx.  
 akt, to suffocate.  
 al, antelope.  
 am, in, with, by, through, from;  
     no, not; to eat; gem, pearl; a  
     beam. [place; to be flogged.  
 ama, a lark; sunbeams; to eat; to  
 amax, to devote, strengthen, bless?  
     hallow. [mon; to envelope.  
 amn, to conceal; to approach; Am-  
 am-naa, some mineral?  
 amn-t, Hades.  
 am-t, devourer.  
 an, stone; whetstone; bristle (of  
     eyebrow); beauty; appearance;  
     of, from, by, for, towards; to  
     adorn; valley; precinct.  
 anez. See anz.  
 anheb, like an ibis; the Coracias  
     Graculus.  
 an-hu, eyebrow.  
 ani, ape; cynocephalus.  
 an-ka, to clasp?  
 an-m, a pearl; a hide; wool.  
 an-m-hat, "stone of heart;" corne-  
 an-nbu, a kind of finch. [liau.  
 an-nu, beauty; appearance; to look  
 ant, yellow; yellow jasper. [back.  
 anta, Anath; Anaitis.  
 an-ti, yellow jasper.  
 anz, life, alive; to live.  
 ap, the head; to rise up, fly on high.  
 ap-a, to rise up.  
 ape, api, head; cornice? first; upon.  
 ap-p, to mount on high; giant;  
     dragon.  
 apt, duck; hold of vessel; peg of  
     door; a kind of wood; Thebes;  
     swan; rib; hippopotamus; geese;  
 apz, tortoise. [fowls.  
 ar, to be, there is; to, towards, to  
     approach; to rise up; gazelle;  
     arura, acre; anklets; a step or  
     pile (game); type; antelope.  
 ara, basilisk, uraeus. [purse.  
 arf, to bind; bag, packet, pouch,  
 ark, conclusion, end; a binding.  
 ari, to guard.  
 arp, vine; wine.  
 arr, grapes; vine; staircase; a hall.  
 art, milk; bracelet, anklet.

- aru, river.  
 as, to approach; address; prayer;  
     noble, principal; rope; chamber,  
     resting-place; then; lo!  
 asb, impious?  
 asf, idleness; fault; end.  
 asi, chief, noble.  
 aspu, to despatch.  
 asr, a tamarisk.  
 ast, some period of time.  
 asz, to mow, reap.  
 at, a clod; loins; to build; to lis-  
     ten; bread; ear; a day.  
 at-ai, chief; noble.  
 atf, father; divine head-dress;  
 ati, lintel. [crown.  
 a-tn, to build, create; the sun's  
 atp, to bear, or load. [disc.  
 a-tu-kar, rigging.  
 au, and, also; born of; to be; a  
     crook; a kind of crane; praeform-  
     mant of future tense; substance.  
 aua, cow.  
 aui, to glorify.  
 auru, a bean.  
 auu, splendor.  
 az, to suspend, invert; to cry out.  
 aza-tr, hare. [hilate, extinguish.  
 azm, eagle, hawk, to soar; to anni-  
 ayt, other [things].  
 azz, darkness; a gryphon; shades.  
 af, to proclaim; to raise up.  
 afr, slice.  
 afru, night.  
 aft, the Persea.  
 ba, wood; iron? soul; goat; kind  
     of chimaera; to be idle; boat,  
 baah, pudendum. [barge.  
 ba-ba, to flow, stream; horns; ex-  
     tremities.  
 bah, to inundate; swill, drink.
- baita, a house.  
 bak, a sparrow-hawk; to chisel,  
     work, carve, decorate.  
 baka, date palm; palm wine; bal-  
 ban, evil; sin. [sam?  
 bari, a mullet.  
 barkabuta, a pool.  
 bas-t, oarlock.  
 basu, dagger; beast of chase; apron.  
 bat, side.  
 bb, gullet.  
 bhn, to cut, incline.  
 bhv, lark, *Alauda Calandra*.  
 bhui, hyena.  
 bka, light; to incline, bow. [trate.  
 bka-bka, to sit down, be quiet, pros-  
 bn, phoenix, nycticorax; harp.  
 bn-bn, to be resplendent; to cap,  
 bnka, a scelopax, bird. [tip.  
 bn-nu, a kind of stone.  
 bnr, palm-tree.  
 br-br, pyramid.  
 bs, beast; hide or skin; date, palm;  
     jet of flame; to accompany, bring;  
     to enter.  
 bs-bs, duck, *Anas leucocephala*.  
 bs-u, dagger.  
 bt, corn; bad, base, abominable;  
 bt-i corn. [barley.  
 btn-nu, abominable.  
 btf, abominable.  
 bu, sepulchre; a thing.  
 bun, dates. [splendor; ceremony.  
 bz, light; to adore; illuminated,  
 bzn, fort, stockade; green basalt.  
 bzta, wicked? denuded.  
 en, not.  
 f, he, him.  
 fa, to bear or carry.  
 fai, to fly.  
 fat, father.

- fnt, worm; nose.  
 fn-ti, breath; to stop.  
 ftu, four.  
 h [u], to strike.  
 ha, cow; duck; husband; head;  
   beginning, chief; to begin, go  
   before; a day, duration; joy, to  
   rejoice; a limb, self; also; field,  
   clay; oh! hail! a substance; an  
   elegant kind of boat? to set up;  
 haa, to be naked. [abode.  
 hab, ibis; to plough.  
 habn, ebony.  
 habnir? kind of collar.  
 haha, to roast, glow.  
 hai, light; a ceiling.  
 hak, to bind.  
 hakhak, name of God.  
 hakr, kind of panegyry.  
 ham, to fish.  
 ham-ham, to roar.  
 han, to adore; to command; box,  
   vase, measure; to acquaint.  
 hanhan, command.  
 hann, deer.  
 han-nu, to command; to supplicate.  
 hap, to conceal, spy.  
 har, to manifest, appear, go out; a  
   day; heart; peaceful.  
 hara, uraeus.  
 harp, to moisten.  
 haru, besides.  
 hat, to terrify.  
 hat-hat, to reconnoitre.  
 hati, heart; to fear; to worship;  
 hat-t, some material. [tow-line.  
 hau, husband; day.  
 hb, panegyry, festival; mourner,  
   undertaker; to plough; ibis;  
 hbb, to flow, stream. [Lower Egypt.  
 hbn, ebony.
- hbs, to clothe.  
 hbt, to steal; to foam.  
 hen, to pray to.  
 hf, a snake.  
 lh, numerous.  
 hi, light.  
 hita, a substance.  
 hk, frog; fillet.  
 lka, to rule, ruler; drink, liquids;  
   frog; numerous; refreshments.  
 hkar, hunger; to starve.  
 hk-nu, to adore; some material.  
 hm, a place; lady, wife; to fish;  
   grasshopper; to govern; rudder;  
   to go out, quit; to stay; to cre-  
   ate; to turn back; locust.  
 hma, linen, flax; lady, wife.  
 hmka, a dark stone or material.  
 hms, to sit; rudder.  
 hmsa, to strangle; bind.  
 hn, to be, appear; to open.  
 hna, together with.  
 hnbi, a fountain.  
 hnhr, mirror.  
 hni, barge of Socharis.  
 hnnu, a duckling; young; an hour.  
 hno, to acquaint.  
 hnt, priest; sanctity; heron.  
 hntr, sanctity of a king.  
 hnz, strap, girdle.  
 hp, bird, duck; to judge, adjust.  
 hpi, oar-blade.  
 hpt, to join, unite; a measure; to  
   offer; a pint; solid food; oar-  
 hptu, poop. [blade; bread.  
 hr, together with; upon, above;  
   path, to go; to terrify; to appear;  
 hrhu, anointed. [to harrow; day.  
 hri, face; above; to fear.  
 hrr, flower; food.  
 hrri, quadriga.

- hrs, a chair.  
 hrt, to be peaceful.  
 hs, to sing, applaud; vex; filthy;  
 throne; sofa; couch.  
 hska, to cut in pieces.  
 hs-mn, natron.  
 ht, heart; a mace; to oppress;  
 white, light, silver; a pool; the  
 sea; a tablet; present; daylight;  
 htar, horse. [bee.  
 htb, libation; to pour out; pool;  
 ht-hr, ocean. [the slain.  
 htr, htra, a horse.  
 htu, gazelle; goat. [calf; filthy.  
 hu, to strike; evil; sin; cave; hill;  
 hua, a rudder, transport.  
 huls, hurs, pillow; head-rest.  
 hunfa, wolf.  
 hu-t, good demon.  
 i, to come.  
 ib, the East.  
 ibt, east.  
 ih, some plant; nosegay.  
 iri, eye; son; to do, to make.  
 iti, a cabin.  
 i-u, ass; to come.  
 iua, to wash.  
 iuma, the sea, ocean.  
 iuspu, end.  
 k, thou, thee.  
 ka, to offer, receive, set up, proclaim,  
 rejoice; a bull, husband, male,  
 he-goat; seed; under; type.  
 kaa, floor; to move.  
 kab, to fold; refresh.  
 kabh, a libation; refreshments.  
 kabi, a honeycomb; a fold; re-  
 kabsak, some substance. [doubled.  
 kaf, monkey, ape; a part of throat.  
 kah, to touch.  
 kahu, shoulder.  
 kahs, a kind of gazelle.  
 kaka, to cackle; to eat, chew.  
 kam, to delight, create; black;  
 black-haired; jasper; gum wood.  
 kambt, ka-em-net, a duck.  
 kamr, camel.  
 kan, a breast; angle; victory; to  
 kan-aa, elbow. [bend; relations.  
 kani, chair.  
 kan-nu, victory; Coracias Graculus.  
 kan-rat, knee.  
 kans, entrails.  
 kant, anger.  
 kapu, a kind of heron.  
 kar, below, beneath, with; to fight;  
 to deceive; an orbit; to rob;  
 privily; a bolt; sunset.  
 kara, sarcophagus, funeral chest; a  
 smith; shrine.  
 karas, mummy; coffin; embalm-  
 karhu, night. [ment.  
 karnata, pudendum; foreskin.  
 karr, an orbit; a furnace.  
 karu, testes.  
 kas, an embalmment. [seat; couch.  
 kat, to build, construct; throne;  
 kau, animal of the ox or deer kind.  
 kaut, to make.  
 kaxa, orichalcum.  
 kf, kfa, to hunt, chase, take prison-  
 ki, another; likewise; to cut. [er.  
 kk, akk, to work as a carpenter;  
 kl. See kar. [darkness.  
 kll, furnace.  
 kna, to bend, deflect.  
 knau, to be idle.  
 kns. See kans.  
 kp, fist; palm of the hand; hour.  
 kr, to bear; have. See kar.  
 krafr, soldier, calasiris.  
 krf, a bowcase.

- ks, that is to say; to entreat, beg;  
ks-ks, a dance. [jasper.  
ksm? a kind of sceptre.  
kspu, jasper.  
labu, lion. [medium.  
m, with, through, by, of, in, as; half;  
ma, true, truth; flax; place; may,  
præformant of optative; mother.  
maai, substance.  
maat, cabin.  
maau, lion; to come.  
maf, copper; copper ore.  
maft-t, lynx.  
mah, cubit; wing; crown of flowers;  
to fill; water; north; north wind.  
mahr, mirror.  
maht, to agree, treat with; some  
liquid in a jar streaming like  
mahu, chaplet; crown. [milk.  
mai, substance; come; may; præ-  
formant of optative.  
mak, to rule; a watch tower.  
makataru, a tower.  
mauz, counterpoise of a collar.  
markabuta, a chariot.  
mas, a calf; to conduct along; to  
mat, granite. [hate.  
ma-ta, a soldier.  
mat-ht, granite; a kind of antelope.  
mati, the nuque of the neck.  
matn, to facilitate.  
matn-uu, road, path.  
ma-t-ra, a witness. [tellect; to die.  
mau, to gleam, light, splendor; in-  
ma-u, a mirror; to see; to come;  
præformant of optative.  
maui. See maau.  
maz. See mfa.  
maza, scale, balance.  
maf, archer.  
meh, manifold.
- menz, utensils.  
meti, half; medium.  
mfka, copper.  
mh, to fill; chaplet, crown.  
mhi, to draw water?  
mhn, asp.  
mht, a buckle.  
mhu, game of the crown.  
mk, to dance.  
mm, the oblique flute.  
mn, to place; a monument; a vase;  
liquid measure; a black durite  
stone; a swallow; turtle dove;  
fore-arm; shin.  
mna, a nurse, wet nurse, to nurse;  
nurse's collar; shepherd; to twine  
rope; to tow a boat; arrive;  
mna-t, signet. [barge.  
mnf, mni, a soldier.  
mnh, species of colchicum; a mine-  
mn-mn, cattle. [ral substance.  
mn-nfr, bracelet, anklet.  
mn-nu, rope.  
mnt, a female breast.  
mnz, to form, make, things made.  
m[n]z-t, whilst. [frontier; circuit.  
mr, to love, kiss; bind; island;  
mra, Egypt. See mr-tar.  
mrh, wax, salt?  
mrs, a beard.  
mr-tar, Egypt; labyrinth-land.  
mru, packet.  
mruri, kind of bird.  
ms, to produce; born; pudendum  
feminæ; to conduct, escort.  
mska, a solid bracelet.  
mss, a strap.  
mst, to hate.  
mstr, ear.  
msuh, crocodile.  
mu, mother; foreigner; to die.

muau, water.  
 mxt, a kind of collar.  
 mfa, an archer; stalk of corn?  
 n, of, to, for, with.  
 na, nai, the (plur. demonst. pronaa, great; ass. [noun).  
 nap, napr, barley.  
 nb, lord; all; gold; to swim.  
 nbi, to gild.  
 nbs, dates; date palm.  
 ne, nen, not.  
 nfr, good.  
 nfri, halcyons.  
 nh, nhai, sycamore.  
 nhas, to erect; raise up; to excite.  
 nhb, neck.  
 nhh, forever.  
 nhm, to save.  
 nhp, to weep, deplore; to make or mould (as a potter); potter's  
 nhsi, negro; revolter. [stand.  
 nif, breath, to blow; air, winds.  
 nini, to entreat.  
 nk, thou, thee; to fornicate; to grind, knead, support.  
 nkaka, to cackle.  
 nkbt, to wash gold.  
 nm, to ravish; force; to take, diminish, pigmy. [rect; water; gold.  
 nu, no, not; to be brilliant.  
 nn-nu, abyss of waters.  
 npa, npra, corn, grain.  
 nrau, vulture; to vanquish.  
 ns, behind; to curse.  
 nsa, behind.  
 nsai, the condemned.  
 nsr, victory.  
 nsu, behind.  
 nt, to avenge, support; to mill; a shuttle; name of a tree. See nk.  
 ntr, a god, goddess; to make.

nts, little?  
 nu, hall, place (n, of; u, sign of nuh, rope, cord. [plural).  
 nuhu, kind of antelope.  
 nuk, I, me.  
 nun, to bear, bring.  
 nu-nu, light.  
 nzm, green feldspar; deck of a boat.  
 nzt, lock of hair; force, strong; to nfm, bulwark, deck. [conquer.  
 nlni, wicked?  
 p, pa, the, this (masculine article).  
 p[e], heaven.  
 pa, mankind; to fly.  
 pai, to fly; person.  
 pa-pa, to give birth to; to bear.  
 ph-ti, vigilant, foreseeing.  
 pkar, horizon.  
 pn, a rat.  
 pna, to invert, go down.  
 pnk, to sprinkle; to capture.  
 pn-nu, a rat.  
 pnti, to detain.  
 prtis, Peritius (a Macedonian ps, to cook; to stretch. [month).  
 pst, the back, spine; to shine; yellow paint.  
 pt, a bow; shaft of a column; to pti, a foot; a bow. [shoot, extend.  
 pt-pt, to trample; put to flight.  
 ptr, to appear? to shoot.  
 pts, foot.  
 pn, to be; the.  
 pui, the.  
 pxa, lioness; gap; plank.  
 pzyr, division; horizon.  
 pzt, to extend; to shoot.  
 pf, to extend; light, to lighten.  
 r, fraction; chapter; mouth; kind of duck; to be, there is, it is; to, towards, for, by, in, of.

- ra, sun; day; door; cell, mansion,  
 prison; to receive; storehouse.  
 rabu, lion.  
 ramax, a monoceros.  
 ran, to please.  
 rf-rf, insect; worm.  
 rhi, garden, plantation.  
 rhn, dawn.  
 rk, to incline; chisel.  
 rka, impudent.  
 rkh, to burn; heat; a brazier.  
 rm, to weep, weeping; ray (fish).  
 rn, name.  
 rnn, to dandle.  
 rnnu, youth, young, to renew; flow-  
 rp, name of an animal. [er.  
 rpa, one of a class; set over; a  
 youth.  
 rr, child; to suckle; dandle.  
 rra, hog; a kind of snake.  
 rrk, kind of insect, centipede.  
 rru, nursling; boar.  
 rs, to suspend, hang, bow.  
 rt, race, men, mankind; foot; seed,  
 to sow; sandstone; sculpture.  
 rta, to place, in order, when.  
 rtb, to beseech.  
 ru, door; mouth; snake.  
 ruma, man.  
 rut, to renew; sandstone; to ger-  
 minate; to engrave; posterity;  
 rutin, to attack. [race.  
 ruzau, heron, Ardea Nycticorax.  
 rz, to speak, declare, acquaint;  
 pure; pure spirit; to full, a ful-  
 ler; to wash; a dream? cousin,  
 rz, pleasure; to delight. [relative.  
 s, she, her, it; a kind of duck; a  
 person; a son.  
 sa, to drag; side; to drink.  
 saah, assembly.
- sab, a jackal; a magus, counsellor;  
 sabu, a finch. [flute; ox; crafty.  
 sabz, to hurl.  
 sah, constellation.  
 sak, mystic animal, chimaera; to  
 sapi, to form, mould, create. [bind.  
 sat, to sew; to hear.  
 satm, to hear.  
 sau, to drink.  
 sb, wall; star; flute; door; propy-  
 lon; gate; the wicked; to adore;  
 Saturn.  
 sba, flute; flute-player; wicked;  
 prop; impious; son; behind.  
 sbaat, to be idle; to omit.  
 sbaau, to glorify; to praise.  
 sbak, to lay out.  
 sbhu, kind of bird.  
 sbk, crocodile; to subdue.  
 sbkt, cabin.  
 sbz-t, gate.  
 se-menx, to build.  
 seneba, to be strong.  
 setem, to hear. [throat.  
 sf, yesterday; sword; to cut the  
 sfr, mystic animal, gryphon. [ter.  
 sf-t, pitch, bitumen; to cut, slaugh-  
 sfz, seven; to overthrow, ruin, cap-  
 ture; impure garments? to noose;  
 to overtake.  
 sha, to collect; a crowd; to encase.  
 s-haa, a stand for vases.  
 shh, bird, Porphyrio hyacinthus.  
 s-hm, to pound grain; to strangle.  
 s-hr, to frighten; terrify; to ap-  
 proach; to drink.  
 s-ht, to give light to.  
 sk, cabin; to molest; to be idle.  
 s-ka, to plough, scrape, play the  
 harp, bind; to collect; a crowd.  
 skar, to cut, soothe, break in pieces.

- sm, an instrument; to gather; fodder; to traverse.
- sma, to tame, subdue; to rule, command; to smite.
- smi, a fly flap.
- smn, to set up; to prepare, lay out; goose; to establish.
- sm-s, preferred, preference, minister.
- sm-sm, minister. [ter.
- smt, stibium.
- sn, they, their; the hair; curl; to pass, traverse; to open.
- sna, to bend, turn away; elbow; knee; brother, sister; to breathe, snaa, to polish. [scent.
- snb, authority.
- snf, blood.
- snh, to bind.
- snk, to lighten.
- snkaus, to nourish.
- snm, to chew, devour.
- sn-n, to bind; orbit.
- sn-nu, sacred cakes; loaf; to search, fish; to enclose; curl; sun's orbit. [adore.
- sns, sns-hu, to give breath to; to snsn, to sue, deprecate; a kind of snt, cake; to found. [heron.
- snti, sindon, flax; a shenti, shirt for the loins; to detain; to steal.
- sntr, incense.
- sn-ut, granary.
- snzn, to nourish.
- sp, a time; to leap.
- sph, ribs.
- spir, the side; to come to the side
- spr, side. [of.
- spt, hips.
- sr, camelopard; sheep; kind of goose or duck; spike; arrow; fire; flabellum; to distribute; a chief, noble; to drink; cheese; to order, dispose, place [supply.
- srk, scorpion; to breathe, scent, s-rka, srta, to chisel, sculpture.
- ss, a kind of wood; eight; to s-sah, to assemble. [breathe.
- s-sat, to be idle.
- ss-i, flame.
- ssni, a mare; a wood, sesamum; to scent, breathe; emerald.
- ssn, to breathe.
- ss-pu, jasper.
- ssr, victory; to breathe.
- ssr-t, to breathe.
- st, odor; addle; rock; land; to extend; arrow; flame; ray, sunbeam; Seth, Typhon, ass; kind of duck.
- sta, skein of thread; to sew; to tow a boat; coitus; gazelle; a mystic animal; to conduct; to spin.
- st-azmu, a bat.
- sth, Cursorius Isabellinus.
- sti, smell, stench; arrow; sunbeam
- stkn, to conduct, accompany?
- stm, stibium; grand priest; to judge.
- stp, approved, tried, select; to s-tr, to deposit on a bier. [judge.
- stut, to tremble.
- stza, woven things. [ley.
- su, he, him, it; corn; wheat; barsua, the south; priestess; come suaz, to glorify. [along.
- suh, an egg; nails.
- sun-t, a king.
- sunz, to nurse.
- sur, south.
- suru, a bomicillo.
- sutn, a king.
- sut-ut, to extend.
- sz, to cut; to open.

- sȳa, to write; paint; to make; a  
 sȳai, a scribe. [finch; a roll.  
 s-ȳar, to make.  
 s-ȳat, a hare.  
 s-ȳb, goading.  
 s-ȳbt, enamel, electrum; tin?  
 sȳin, a lotua.  
 s-ȳm, to shut; the breast.  
 sȳnt, a tunic.  
 s-ȳp, to bear off.  
 s-ȳr, to overthrow; a section.  
 s-ȳt, net; capsize, invert.  
 sȳu, stick, kind of mace.  
 sȳz, sistrum; to play the sistrum.  
 sȳzm, to rejoice. ●  
 s-f, to shut, bolt; a nest.  
 s-fm, shrine. [escort.  
 t, thou, thee; feminine article; to  
 ta, the (fem. demonstr. pronoun);  
 to give; kind of crane; to go by  
 boat; to carry; to offer; to sac-  
 rifice; the world; boat, barge.  
 taf, father.  
 takai, the adherer, a bat.  
 tam, kukufa sceptre; power; to  
 tam-ua, hair. [bear, carry.  
 tar, to grow; time.  
 tat, olive; oil.  
 tau, to burn.  
 taz, the frontier.  
 tb, brick; finger; prætorium; kind  
 of vase; box; to subdue.  
 tba, chest; sarcophagus; a wrap.  
 tb-h, a measure, weight, signet; a  
 tb-t, hippopotamus. [prayer.  
 tb-tb, to prostrate.  
 tb-ti, sandals; a prayer.  
 tf, father; to hoe; kuphi, perfume.  
 tf-tf, to drip.  
 th, latchet of a sandal.  
 tha, straw; to reel, be drunk, clip.  
 thni, forehead; to bow the forehead.  
 ths, to grease (leather); shoe-latchet.  
 th th, thti, lead.  
 thu, table.  
 thun, to rise up.  
 ti, a chief.  
 tka, flour; a spark; to adhere.  
 tkai, kind of bird; sale.  
 tka-r, to join or twist cords.  
 tm, no, not; the Recurvirostra Avo-  
 cetta; to transport; to escape,  
 avoid.  
 tma, to separate; distinguish; sca-  
 tmat, to stupefy. [rify; subdue.  
 tms, a kind of bird.  
 tn, bent; conduct.  
 tna, half; a fortnight.  
 tnh, wing.  
 tnhu, prisoner.  
 tn-nu, to elevate, rise up; to send;  
 to conduct; a chest; to move.  
 tnru, to break, smash.  
 tnt, Charadrius armatus.  
 tn-tn, to revolt; pride.  
 tp, to taste; cakes; to guess; to  
 receive; hour.  
 tpak, a sail; kind of bull?  
 tph, cavern.  
 tpp, to taste.  
 tpt, boat; hull; cake.  
 tr, to transfix, bruise, rub; time;  
 path? increase; to work, make,  
 fabricate; shoot; whilst; to be;  
 trf, to dance. [to embalm.  
 trp, a wild duck.  
 ts, to distinguish; to suspend, sling,  
 lead along; self; to transport.  
 tsm, a male cat?  
 tsnu, slice, cut.  
 tt, oil; hand; papyrus; to speak;  
 tta, eternal. [to establish.

- ttfi, a reptile.  
 tts, lord; exalted.  
 tu, to pollute; a command; name  
   of a region; a hill; to speak.  
 tua, to worship.  
 tuana, to slaughter.  
 tuaut, green color?  
 tum, to place.  
 tut, a statue; some part of body.  
 tu-tu, pollute.  
 tχ, a weight; to disturb; appoint.  
 tχa, a fort.  
 tχn, an obelisk.  
 tχr, gore.  
 tχ-tχ, to order.  
 tfr, red; red crown. [I, me.  
 u, to come, approach, unite, collect;  
 ua, long, length, distance; a sacred  
 uaa, boat, barge. [boat.  
 uab, pure; priest.  
 uah, to pour out; feed.  
 ubn, light, to illuminate; brilliancy;  
   to shine; a kind of game.  
 ubt, boiling.  
 ufa, to chastise.  
 uha, to stretch.  
 uhar, a dog.  
 ui, light, brilliancy.  
 ukar, a part of time.  
 'un, to shine, appear, light; to open;  
   an hour; to be, being; a duck-  
   ling. (Coptic, one.)  
 'un-nu, an hour; young.  
 'unun, name of a bird.  
 'unχ, a strap, girdle.  
 'unf, wolf.  
 'ur, elder; crown.  
 'urr, crown.  
 'urri, war-chariot.  
 'urs, pillow.  
 'urt, placable, meek.  
 us, to saw.  
 usb, to stack corn.  
 usr, oar; defending.  
 ust, to eat?  
 usχ, large, broad; a saloon; boats  
   of burden; holds; collar; to  
 'ut, to glow, light; green. [mow.  
 uta, to go out; to divide; between.  
 utau, a pectoral plate; kind of crane;  
   the symbolical eye of the sun; a  
 'utb, to pour out. [pendant.  
 utbu, wells.  
 utn, consecration; ingot.  
 utn-nu, libation.  
 uts, to sustain, try, examine; to  
   carry; to go out; palanquin.  
 utu, stern of boat.  
 uz, pure, illumined; splendor; cere-  
 ufa, to eat. [mony.  
 ufau, darkness.  
 uf'b, to answer.  
 ufm, ear of grain?  
 χa, altar; to resemble; a body; to  
   measure; a thousand, many; to  
   make; food. [chief, above.  
 χaa, born, to exist; dagger; first,  
 χab, hypocrite, cheat; a star.  
 χabsm, name of a spotted dog.  
 χabu, to mow.  
 χai, a cat.  
 χaibt, fan.  
 χaiu, altar.  
 χak, to shave.  
 χanru, to disperse.  
 χart, child, offspring.  
 χas, evil; wretched.  
 χast, some part of body.  
 χat, dead body.  
 χatab, pottery.  
 χatb, to fall.

- χau, a cat; hypocrisy; length; al-  
 χaui, a sow; altar. [tar.  
 χb, to plough; wasp; Lower Egypt;  
 papyrus; hypocrisy; deceit; to  
 χba, to plough. [violate; to dance.  
 χbb, the gullet.  
 χbni, to starve.  
 χbs, to clothe.  
 χbt, to dance, to tumble; iniquity.  
 χfa, fist, power.  
 χft, enemy, devil; when; a repro-  
 χi-χi, to mill, beat. [bate.  
 χm, no, not; to afflict; to bruise;  
 annihilate; chest; hemp.  
 χmhu, to imagine.  
 χmi, enemy.  
 χms, flax; ear of corn.  
 χn, a breast; to bear? a child; to  
 conduct; vestibule; likeness; to  
 χnark, to restrict. [place.  
 χnf, a kind of cake.  
 χnm, to seek? to smell? to sleep?  
 a kind of nurse; brass; red jas-  
 χnms, a tutor. [per.  
 χn-nu, to conduct, send; a box.  
 χnp, to deliver; join?  
 χnr, cap, casque.  
 χns, to hunt.  
 χnt, to approach, tread on; entrance.  
 χp, a fist; a turn, as "once, twice."  
 χpf, part of a boat.  
 χpi, the winged uræated disk.  
 χpr, scarabæus; to exist; shape,  
 χprf, helmet. [type.  
 χpt, thigh; neophron duck.  
 χpx, thigh; ursa major; scimitar;  
 to smite with the scimitar.  
 χr, to, at, with, under; section;  
 picture; to fall; to smite; child,  
 offspring, youthful; leaf.  
 χrp, first, principal; to consecrate,
- offer as first fruits; paddle-blade;  
 image. [or fodder.  
 χrf, bundle of arrows; truss of hay  
 χsbt, enamel, electrum? tin? blue.  
 χsf, to anchor a boat; go back; stop.  
 χsr, to disperse, clear.  
 χt, to navigate; shut; net; flame;  
 χtb, to tumble; to subdue. [other.  
 χtu, to shut; a fort.  
 χtui, war-axe.  
 χtr, to consent.  
 χu, to rule, reign, direct; long.  
 χz, gullet; to balance; to adjust;  
 l, pool, reservoir, tank. [to whip.  
 fa, a cake, bread; first; high; fes-  
 tival; diadem; a bushel; book;  
 faau, boar. [wood.  
 fakr, to adorn?  
 fas, to run through, traverse.  
 fasu, a shepherd.  
 fat, to cut.  
 fau, boar.  
 fba, a slice.  
 fbn, glass.  
 fbt, porcelain.  
 fbu, cords; kind of collar.  
 fb-fb, to transform?  
 ff, a ram; to desolate.  
 fft, to desolate; to fashion; a ram.  
 fiu, long, when; power.  
 fm, to arrange; to walk; bolt.  
 fna, a net.  
 futi, tunic; apron; flax.  
 fp, to take; an hour.  
 fpn, a kind of bread or grain.  
 fr, to smite; struck; a case; to-  
 fra, a nostril. [wards; night.  
 frau, a child.  
 fs, a kind of antelope.  
 fsf, to turn back, stop.  
 fta, shut, place; tomb; prison;  
 ftrau, kind of antelope. [confine.